River Suir Sustainable Transport Bridge

Environmental Impact Assessment Report
Volume 2 Main Text | December 2018

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List of Volumes comprising this Environmental Impact Assessment Report

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Mizen Archaeology

Underwater Archaeology

Aquafact Environmental Consultants

Benthic Ecology

TABLE OF CONTENTS – VOLUME 2

Non-Technical Summary

Non – Technical Summary

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Non-Technical Summary of the Environmental Impact Assessment Report

Table of Contents

1.0 Introduction

This Environmental Impact Assessment Report (EIAR) has been prepared in respect of the construction and operation of the River Suir Sustainable Transport Bridge, hereafter referred to the 'proposed development', by Roughan & O'Donovan (ROD) consulting engineers and a team of specialist sub-consultants, with the assistance of Waterford City and County Council.

The EIAR is presented in three volumes; this standalone Non-Technical Summary is Volume 1, Volume 2 contains the main text and Volume 3 contains the associated Figures.

It should be noted that surveys, assessments and information that form the basis of this EIAR are based on the current design of the proposed development which has been developed to a stage that permits a fully informed EIA. While some developments and refinements of the current design may occur during the detailed design stage, any such iterations of the development, if approved, will not include any significant adverse impacts on the environment not dealt with within this EIAR.

1.1. Overview

The proposed development comprises a sustainable transport bridge crossing the River Suir in Waterford City and includes a paved and landscaped plaza at the landing point on the South Quay, in direct proximity to the Clock Tower. It is anticipated that the proposed bridge will provide a new pedestrian, cycle and courtesy electric bus link between the North Quays and South Quays, promoting the further development of Waterford City and facilitating the development of the North Quays Strategic Development Zone (SDZ) lands. The proposed development is termed a 'Sustainable Transport Bridge' as it will support sustainable modes of transport including pedestrians, cyclists and electric bus users. The bridge will be approximately 207m in length and will allow the extension of the retail spine from Waterford City across to the North Quays SDZ.

On the South Quay the proposed bridge will land in the vicinity of the Clock Tower on Meagher's Quays. The North Quays at present comprise an assembly of wharves consisting of disused open spaces following the demolition of disused industrial buildings in 2016 and the Hennebique grain store building in July 2018. The Rosslare to Waterford (via Belview) rail line terminates to the east of the North Quay landing point.

Rice Bridge is currently the only crossing of the River Suir within Waterford City centre and the current pedestrian access from the north quays to the south quays entails walking upriver along Dock Road, crossing Rice Bridge to the south quays and walking along Merchant's Quay (R680). While there are cycle lanes along Merchant's Quay in both directions, there are no cycle facilities provided along Dock Road or Rice Bridge and it is a hostile environment for cyclists. The Ferrybank and Bellfield areas are residential areas to the north of Waterford City with limited connectivity to Waterford City other than by car or bus.

1.2. Requirement for an EIAR

This EIAR has been prepared in full accordance with the relevant provisions of Directive 2011/92/EU on the Assessment of the Effects of Certain Public and Private Projects on the Environment as amended by Directive 2014/52/EU. Regard has also been had to the current provisions of the relative Irish legislative codes including the Roads Act 1993, as amended, as they continue to apply at this time.

Section 50 of the Roads Act (1993 - 2015), as amended, sets out provisions for the preparation of an EIAR. The prescribed type of proposed road development, as defined by paragraph 8 of the Roads Regulations (S.I. No.119 of 1994), for the purpose of subsection (1) (a) (iv) of Section 50 of the Act is as follows:

"(a) the construction of a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road would be eight kilometres or more in length in a rural area, or 500 metres or more in length in an urban area;

(b) ***the construction of a new bridge or tunnel which would be 100m or more in length****."*

Taking this legislation into account, the proposed River Suir Sustainable Transport Bridge requires that an Environmental Impact Assessment Report is prepared under the Roads Regulations (SI. No. 119 of 1994) subsection (1) (a) (iv) (b) of Section 50, as the proposed development comprises the construction of a new bridge of 207m in length, exceeding the prescribed length of 100m. Therefore, the proposed development exceeds the threshold for which an EIA is automatically required.

2.0 Need for the Proposed Development

The need for the River Suir Sustainable Transport Bridge has been identified in and / or is consistent with the following European, national, regional and local planning policy documents:

European Policy Context

- EU Cycling Strategy, 2017; and
- EuroVelo.

National Policy Context

- Ireland 2040 Our Plan, National Planning Framework, 2018;
- The National Spatial Strategy, 2002 – 2020;
- Smarter Travel: A Sustainable Transport Future, 2009 – 2020;
- National Cycle Policy Framework, 2009-2020;
- Building on Recovery - Infrastructure and Capital Investment, 2016 – 2021;
- Investing In Our Transport Future: A Strategic Framework For Investment in Land Transport; and
- Project Ireland 2040, National Development Plan, 2018-2027.

Regional Policy Context

- Regional Planning Guidelines for the South East Region, 2010-2022;
- The Southern and Eastern Regional Operational Programme, 2014-2020; and
- The South East Economic Development Strategy (SEEDS), 2013-2023.

Local Policy Context

- Waterford North Quays Strategic Development Zone Planning Scheme, 2018;

- Waterford City Development Plan, 2013-2019;
- Waterford County Development Plan, 2011-2017;
- Waterford Planning, Land Use and Transportation Study (PLUTS) 2004;
- Waterford North Quays Urban Design Framework Plan, 2008;
- Ferrybank – Bellview Local Area Plan, 2017;
- Kilkenny County Development Plan, 2014-2020;
- Waterford City Centre Urban Renewal Scheme, 2015;
- Economic Strategy for Waterford City and County, 2013; and
- One Waterford: Local Economic & Community Plan, 2015-2020.

3.0 Alternatives Considered

3.1 Bridge Options Considered

The following five options were assessed for the proposed bridge:

- Bridge Option 1 – Functional Opening Bridge;
- Bridge Option 2 – Aesthetic Opening Bridge;
- Bridge Option 3 – Functional Fixed Bridge;
- Bridge Option 4 – Aesthetic Fixed Bridge; and
- Bridge Option 5 – Alternative Aesthetic Fixed Bridge.

Bridge Option 1 – Functional Opening Bridge

The proposed bridge is 217m in length with a constant deck footway/cycleway width of 6m over its length. The bridge deck layout consists of 7 spans; a 38m long central span (opening) and four interior and two end fixed spans of 33m and 26m length respectively. The opening span is a single leaf bascule (fixed trunnion type) with approximately 30m of its length lifted about the pivot and the remaining length accommodating the lifting device/ machinery and counterweight. This arrangement provides the required 25m wide navigation clearance.

Bridge Option 2 – Aesthetic Opening Bridge

The proposal for this option is an architecturally designed bridge with structural and aesthetic features designed to enhance the user experience of the crossing as well as enhancing the long views from the length of both quays. The perceived length of the 6m wide x 217m long crossing has been reduced with the introduction of feature arches/viewing points at approximately the bridge third points in conjunction with a varying footway vertical profile which forms a smooth curve in elevation. The 7-span bridge deck has been laid out symmetrically and comprises a 70m long central span (14m wide opening section), interior spans of 35m and 25m, and end spans of 12.245m length. The opening section of the central span is detailed as a hydraulically operated twin leaf bascule bridge with all hydraulics located within the depth of the bridge deck. A proposed navigational clearance of 25m has been agreed.

Bridge Option 3 – Functional Fixed Bridge

The proposed bridge is 217m in length with a constant deck footway/cycleway width of 6m over its length. The bridge deck layout consists of 7 spans; five interior spans of 33m and two end spans of 26m. The bridge deck layout consists of 7 spans; five interior spans of 33m and two end spans of 26m. The bridge piers will be supported on pile caps located below the low water mark. 750mm diameter vertical and inclined steel cased bored concrete piles are proposed with the number of piles varying at each substructure to suit the loading requirements. Based on the available ground investigation data at the constraints stage, piles will have an average length of 17 to 18m assuming a bedrock level of 17.7mOD. The proposed fixed bridge has a maximum vertical navigation clearance of 5.1m at daily low water over a 25m navigation channel, allowing the passage of small crafts.

Bridge Option 4 – Aesthetic Fixed Bridge

This option is as per Option 2 except the central span is fixed (i.e. not opening to allow the passage of larger vessels). The proposed fixed bridge has a maximum vertical navigation clearance of 7.8m at daily low water over a 25m navigation channel, allowing the passage of small vessels.

Bridge Option 5 – Alternative Aesthetic Fixed Bridge

Bridge Option 5 is an alternative simplified aesthetic fixed bridge with a more conventional deck and pier supports in comparison to Option 4. The perceived length of the 6m wide x 217m long crossing has been reduced with the introduction of a feature flat arch located centrally in the deck at the bridge central span location. The 5-span steel bridge deck has been laid out symmetrically and comprises of an 80m long central span with two interior spans and two end spans of 40m and 28.5m lengths respectively. The 7m deck structural width is made up of a 2.5m wide main trapezoidal shaped box girder with varying depth transverse cantilevers extended 2.25m either side to the deck edges.

Options 2 and 3 are the most preferential options for the opening and fixed bridges respectively. Following consultation with river users during the option evaluation process, it was agreed with Waterford City and County Council, that an opening bridge should be considered at the bridge site to allow unrestricted passage for navigational vessels. As a result, Option 2 was selected by WCCC in January 2017 as the preferred option to progress to the preliminary design stage. In conclusion, the Multi-Criteria Assessment has identified Option 2 as the preferred bridge option for the River Suir Sustainable Transport Bridge.

3.2 Multi-Analysis Criteria Applied

Each of the five bridge options proposed were rated based on the following criteria.

- Aesthetic Merit and Appropriateness;
- Environmental Impact;
- Durability and Future Maintenance Needs;
- Buildability;
- Construction and Whole Life Costs;
- Hydrology and Hydraulics;
- Navigation Considerations;
- Integration with Flood Defence Scheme;
- Disruption/Impact during Construction; and
- Safety.

Following consultation with river users and a number of Consultees during the option evaluation process, it was agreed with Waterford City and County Council, that navigation on the river could not be eliminated and therefore an opening bridge should be selected to allow unrestricted passage for vessels. As a result, Option 2 was therefore selected as the preferred bridge option for the River Suir Sustainable Transport Bridge as it is the preferred option on all grounds (with the exception of navigation) including most critically from an Environmental perspective.

3.3 Bus Route Options Considered

Three alternative bus routes for the public transport vehicle were considered and assessed. The 3 route options assessed included:

- a route which crosses the proposed bridge, travels up Barronstrand Street and Broad Street, turns left onto Peter Street, turns right into Bakehouse Lane, turns right into Lady Lane, turns right onto Michael Street and reconnects to Broad Street/Barronstrand Street;
- a route which crosses the proposed bridge, travels up Barronstrand Street, Broad Street and Michael Street and turns at the junction of Michael Street and New Street;
- a route which travels over and back across the bridge only, with the future ability to turn left onto Merchant's Quay from the bridge and to turn left onto the bridge from Merchant's Quay.

The route which travels over and back across the bridge emerged as the preferred electric shuttle bus route option. However, there is potential for the bus route to be extended to service a wider catchment area in the future, for example to the Viking Triangle tourist attraction to the south and to schools, houses and community facilities in Ferrybank to the north. The proposed bus route will connect Waterford City centre with the North Quays Strategic Development Zone (SDZ).

The following seven bus types were considered as options for the mode of public transport crossing back and forth across the proposed bridge:

- MotoEV Electro Transit Buddy 15 passenger hard door ADA shuttle;
- MotoEV Electro Transit Buddy 12 passenger hard door shuttle-short;
- MotoEV Electro Transit Buddy 15 passenger XE hard door shuttle;
- A CitEcar Electro Transit Buddy 15 passenger hard door ADA Shuttle;
- Bintelli ADA Enclosed Shuttle 11P 1WC;
- Phoenix Zeus Electric Shuttle Bus; and
- EasyMile EZ10.

Following assessment of the different options, the 15 passenger MotoEV Electro Transit Buddy 15 Passenger Hard Door ADA Shuttle emerged as the preferred option as it is wheelchair accessible, aesthetically pleasing, manual and accommodates a sufficient number of passengers.

4.0 Description of the Proposed Development

Chapter 04 of the EIAR provides a description of the proposed River Suir Sustainable Transport Bridge which is summarised below. It is based on the design and includes details of the engineering features, land requirements and construction and operation requirements. The primary elements of the design are presented in the following sections.

The bridge site location is approximately in line with Barronstrand Street and in front of the existing Clock Tower, as presented in Figure NTS1. The bridge is a sustainable transport bridge which accommodates pedestrians, cyclists and an electric bus shuttle service between the north and south quays. The bridge also accommodates an opening section which facilitates navigation of vessels along the River Suir.

The proposed 5-span, 8m wide bridge (inside of parapet to inside of parapet) will accommodate pedestrians, cyclists and an electric shuttle bus service. The bridge is also locally widened in two locations (approximately located at third points across the bridge) to facilitate repose and look out areas, as presented in Figure NTS2. Cyclists and the electric shuttle bus will be facilitated through a shared-space lane, whilst pedestrians will be provided with a primarily segregated area of the deck cross-section. There are some locations at the centre of the span and the south plaza where all the spaces are shared spaces between pedestrians, cyclists and the electric bus. The proposed development also comprises a plaza at the South Quay landing point. This plaza will be a paved and landscaped space for the streetscape around the Clock Tower. Approximately 143 car parking spaces will be removed from the existing car parks along Merchant's Quay for the construction of the South Quay Plaza.

The sustainable transport bridge crossing point is approximately 550m downriver of Rice Bridge. The river is in the region of 207m wide at this location, measured between the edge of the south quay and the shore edge of the north side wharf and is part of the Lower River Suir Special Area of Conservation (SAC). The south quays area at the proposed bridge location currently consists of the Clock Tower and car park spaces whilst the north quays is a former industrial brownfield site which shall be developed as a Strategic Development Zone (SDZ). There is also an existing marina located on the south quays which will be directly impacted by the proposed bridge.

The proposed main site compound on the South Quay, will include offices, materials storage areas, plant storage and parking for site and staff vehicle s. The site is likely to remain in place for the duration of the contract but may be scaled up or down during particular activities on site. The compound(s) may be used either in full, in part, not at all, or another location could be selected, in agreement with the client subject to compliance with all environmental, planning and legal requirements. It is also envisaged that raw material, particularly steel bridge sections for bridge construction will be moved by barges along the River Suir to the site.

A number of Outline Environmental Management Plans have been drafted as part of this EIAR which will be finalised by the successful contractor prior to any demolition, excavation or construction phase to ensure commitments included in the statutory approvals are adhered to.

5.0 Traffic and Transport

It is anticipated that the proposed development will encourage modal shift from cars towards more sustainable means of transport (i.e. walking, cycling, and electric shuttle bus), for people travelling from the suburbs to the north of the River Suir towards Waterford City Centre. This should also reduce the amount of traffic using Rice Bridge and therefore improve the pinch point situation that currently exists.

During construction, a large portion of the Clock Tower Car Park area will be closed for the duration of the works to facilitate the construction of the proposed bridge, southern plaza area, and connection to the adjoining road network.

During operation, the provision of a sustainable transport bridge will greatly benefit commuters and will likely encourage people to swap to active transport modes for their commute. It is anticipated that with the provision of the proposed bridge, the overall travel distances for pedestrians and cyclists between the City Centre and these residential areas will be reduced by up to 1km or equivalent to 12-14 minutes' walk or 5 minutes cycle.

6.0 Population and Human Health

The EIAR has considered and assessed the likely significant effects with regard to population and human health associated with both the construction and operational phases of the proposed River Suir Sustainable Transport Bridge. The proposed development is located in the two Electoral Divisions (EDs) (Ferrybank and Centre A). In 2016 census, the total combined population residing within these EDs was 1,649 persons. The primary land uses are commercial uses along the south quays with some residential including hotel uses located within the study area. Human health of the population in the area is reported as very good (census 2016).

The assessment has found that the construction phase is likely to interrupt journey characteristics and general amenity deemed to result in moderate, negative short-term impacts. The loss of parking on the south quays, construction activities and site compound may negatively impact on the business environment and residential amenity land uses in this area. However, the construction stage is also likely to result in positive impacts on the local economy due to employment and local expenditure by construction workers, purchases of local materials and services. Emissions from the construction activities such as noise, air and risk of accidents were found to be potential short-term negative impacts. It was found that noise emissions from construction activities, plant and machinery on site is likely to have a significant noise impact within the immediate area during distinct construction phases (i.e. piling and excavation activities) of the development. However, with the application of various best practice working methods to control noise the impact is reduced to moderate, negative short-term. All impacts will be short-term in nature and reduced and managed by CEMP and associated TMP, EOP and CWDP and the range of mitigation measures detailed in Chapter 6 of this EIAR.

Overall, the operation of the proposed development is expected to have positive, long-term impacts on the population and human health of the City and South East region. The assessment found that the proposed development is likely to result in positive long-term change to land use intensity and the nature of activities in Waterford City and for the population's journey characteristics, journey amenity and general amenity due to the improvement in transportation infrastructure and improved connectivity to existing and future developments in the City (i.e. Greenways, future transport hub, regeneration of the NQ SDZ). Journeys by foot and bike are likely to become safer and more pleasant. The bridge will provide relief from existing severance currently experienced north and south of the river.

Improvements are also likely to the population and visitors with regards to general amenity, safety and quality of life issues associated with the sustainable transport bridge and also improved connectivity between cultural, commercial and residential quarters across the City. The proposed development will result in direct employment of a minimum of 2 bus drivers, resulting in direct positive impacts to the local economy. There will be improvements to the public realm due to a new South Plaza and look out areas as part of the bridge structure which are likely to result in positive indirect impacts for the local economy. It was found that the risk of suicide death due to the construction of a new bridge structure in the City has the potential to have a profound human health impact. The provision of combined structure / parapets and wind-shielding on the proposed development will make the bridge more difficult to climb than for example the existing Rice Bridge and hence act, somewhat, as a deterrent to potential suicide deaths occurring at this location. Overall, impacts are likely to be positive in terms of supporting improvements in the populations health and well-being due to the provision of safe, affordable, sustainable travel modes that conform with existing and future planning policy and support a change in travel behaviour and sustainable development in city centre locations.

7.0 Biodiversity

The Key Ecological Receptors likely to be impacted upon by the proposed development include the River Suir, Migratory Fish, Otter, Bats and Invasive Alien Species. Each Key Ecological Receptor has been characterised in terms of their conservation value on a geographical scale. The assessment analyses the potential impacts of the proposed development on these Key Ecological Receptors and characterises their likely effects in terms of their magnitude, extent, duration, frequency and reversibility, thereby determining the significance of effects on a geographical scale.

One Key Ecological Receptor (River Suir) will be permanently affected by the proposed development relating to direct habitat loss within the footprint of the proposed development. However, given the small area of loss this impact is not considered to be significant. There will be slight to imperceptible impacts to water quality in the River Suir arising from the proposed development.

The Natura Impact Statement (NIS) concluded, in view of best scientific knowledge and the Conservation Objectives of European sites, that the River Suir Sustainable Transport Bridge, either individually or in combination with other plans or projects, will not adversely affect the integrity of the Lower River Suir Special Area of Conservation (SAC) or the River Barrow and River Nore SAC or any other European site.

Provided that the River Suir Sustainable Transport Bridge is constructed and operated in accordance with best practice guidelines and the mitigation measures described, there will be no likely significant effects on the ecology within the Zone of Influence at an International, national, county or local level. There are no other residual effects likely to be significant at the local, county, national or International level, and furthermore, the assessment found no likely significant effects arising from the cumulation of the impacts from the River Suir Sustainable Transport Bridge with the impacts from other past, present or reasonably foreseeable developments. Following consideration of the residual (post-mitigation) impacts, it is noted that the River Suir Sustainable Transport Bridge will not result in any significant impacts on any of the identified Key Ecological Receptors.

8.0 Soils and Geology

The EIAR has considered and assessed the likely significant effects with regard to Soils and Geology associated with both the construction and operational phases of the proposed River Suir Sustainable Transport Bridge. Geophysical surveys, Ground Investigations and contamination assessment were all carried out to inform the Soils and Geology assessment. The results of the geophysical investigation indicate the area is characterised by thin sediments over shallow weathered – fresh rock in the northern area with thicker sediments present in the south. The Tier 3 Risk Assessment for contaminated soils found that all samples recovered were classified as non-hazardous.

The construction of the proposed development will require a combi-wall (combination of steel tubular piles and sheet pile panels) at the south abutment location in front of the existing quay wall to form the abutment foundations. Tubular piles will be installed using impact hammer while sheet pile panels will be vibrated. A new sheet pile wall will be installed immediately in front of the existing quay wall at each side of the south abutment for a length of approximately 35m in order to retain the increased levels at the south plaza and approach to the bridge.

The raising of the levels at the South Quays for the purposes of the south plaza ramp will require the importation of a small amount of general fill. The fill's weight will induce the settlements in the underlying soft soils. If untreated, this would cause a significant long-term negative impact. The mitigation measures for this may include surcharging, (with or without vertical wick drains) or piling. The surcharging will include the handling and temporary placing of a reasonably small quantity of general fill (approximately 1m height) on the ramp footprint, causing a slight temporary negative impact, for a period of up to 14 months. The piling option will be specified as Continuous Flight Auger (CFA) piles, which will minimise noise and vibration and introduce a need for disposal of a small quantity of arisings (less than 50 m^3), causing a slight short-term impact. The existing floating jetty located at the south abutment will be removed at the bridge footprint. The impact associated with this operation is minor and adverse. The north abutment construction will be performed in front of the existing north quay and will not require demolition of the existing wharf to execute piling. The north abutment will tie into the proposed north quays development which is located approximately 5.00m above the existing level of the north wharf. The impacts on soils associated with this location are likely to be negligible.

Cofferdams are required for construction of the foundation supports to the bridge piers within the river. Cofferdams will be constructed using vibratory driven sheet piles. During piling construction operations within the river, there is the potential for contamination of the river due to sediments and runoff associated with construction works or fuel spills entering the river.

In general, the temporary and permanent impacts on soils and geology are considered minimal and will be managed by a number of best practice control measures.

No significant residual impacts of soils and geology are anticipated as a result of the proposed development.

9.0 Hydrogeology

Excavation of made ground will take place during the construction of the proposed development. The excavation of any localised areas of ground contamination will be a Permanent Positive impact on the soils environment due to the requirement to remove the material off-site and dispose or treat it in accordance with relevant legislation. Any improvement to the quality of soils will have a corresponding benefit to the underlying groundwater resources due to the removal of a potential source of contamination for percolating water. Therefore, the magnitude of this impact is Minor Beneficial due to a minor improvement to the attributes quality.

There is a potential risk of localised contamination from construction materials leeching into the underlying soils by exposure, dewatering or construction related spillages resulting in a Permanent Negative impact on the soils. In the case of soils, the magnitude of this impact is Small Adverse as the requirement of good construction practices will necessitate the immediate excavation/remediation of any such spillage resulting in a very low risk of pollution to the soils and consequently the underlying aquifers. The significance of this impact is Imperceptible.

There is a potential risk of localised contamination of the groundwater due to construction activities i.e. construction spillages, leaks from construction plant and material etc. resulting in a Permanent Negative impact on groundwater. The presence of this low permeability alluvium (and tills) will limit the potential for contamination to infiltrate into the underlying aquifer.

However, the requirement to construct piles through the overlying soils, which have been shown to be slightly contaminated at discrete locations, could potentially create a preferential flowpath through the subsoils directly into the bedrock allowing some of these contaminates to mobilise. Expected construction practice will involve the piling to take place in the dry within temporary cofferdams. A base concrete slab will be constructed prior to pile installation to seal the potential pollution source. All foundation piles will be filled with concrete immediately after excavation preventing contamination of the bedrock aquifer. For these reasons, the impact is Negligible on the groundwater contained within the bedrock aquifer. The significance of this impact is Imperceptible.

The operational phase of the proposed development is predicted to have an overall Neutral long-term impact on hydrogeology within the study area. During the operational phase runoff from the proposed development which may be polluted with either sediment or hydrocarbons/metals may enter the River Suir and degrade water quality.

A project-specific Environmental Operating Plan (EOP) and Outline Construction Environmental Management Plan (OCEMP) have been prepared for the proposed development. The EOP will cover all potentially polluting activities and include an emergency response procedure. As a minimum, the EOP for the proposed development will be formulated in consideration of the standard best practice. Once the relevant mitigation measures are implemented, the significance of all residual impacts has been found to be imperceptible.

10.0 Hydrology

The proposed River Suir Sustainable Transport Bridge crosses the River Suir in Waterford City from the Waterford North Quays SDZ to the clock tower on the South Quays. The main potential for contaminants to enter into the hydrology environment arising from construction runoff include:

- Elevated silt/sediment loading in construction site runoff;
- Spillage of concrete, grout and other cement-based products;

- Accidental Spillage of hydrocarbons from construction plant and at storage depots / construction compounds; and
- Faecal contamination arising from inadequate treatment of on-site toilets and washing facilities.

A hydrodynamic model was undertaken to assess the existing hydrodynamics of the Suir Estuary and the effects of the proposed bridge on the circulation patterns of the estuary. The predicted scour depth in the channel between the cofferdams is 4 to 4.5m after a 24 day simulation with the sediment deposited locally in the channel within 150m upstream and 300m downstream. The potential impact is moderate to significant. The hydraulic model was also undertaken to predict the impact on flood levels both locally upstream and downstream. Impacts were found to be extremely small and less than the modelling tolerance.

A section of the existing flood defences on the south quays will be altered at the southern abutment and two smaller sections replaced with flood gates to provide access to the new jetties. The potential impact is slight.

The hydrodynamic model was run to simulate the effect of the proposed bridge crossing. The simulation indicates that the proposed bridge results in localised erosion at the structure principally away from the piles with the deposition of the eroded material occurring local to the site both upstream and downstream of the bridge. The extent of deposition from the scouring is located within 150m upstream of the bridge and 300m downstream. The scour depth at the bridge after a 24day simulation period is 1.5m and it likely to double to 3m over time after which an armouring layer of the heavier fractions left behind will prevent further scouring of the channel at the bridge. The hydrodynamic modelling indicates that erosion and deposition of the river bed will remain local to bridge structure (within 150m upstream of the bridge and 300m downstream).

The volumes displaced by the proposed bridge piers, abutments and cofferdams during construction phase is extremely small relative to the volumes of the receiving waterbodies and will result in an imperceptible.

The existing flood defences on the south quays will have to be removed to allow for the integration of the bridge abutment. Tide level and weather forecasts shall be monitored for potential flood events. Temporary flood defences shall be provided during construction at this location to maintain the south quays flood defences to a level of 3.7mOD.

The south quays plaza and the southern half of the bridge will drain to the existing surface water drainage system. This is treated at the Waterford City Water Treatment Plant before discharge to the River Suir. On completion of the SDZ development the north section of the bridge will discharge to the North Quays surface water drainage network, this will incorporate pollution control measures including silt traps, petrol interceptors and SuDS components treating all runoff prior to discharging to the River Suir. The potential impact is slight to imperceptible.

The risk of pollution to both surface and groundwater resulting from accidental spillage is an issue considered in the development to be negligible. The bridge traffic is limited to pedestrians and an electric shuttle bus. It is not anticipated that any chemicals or hydrocarbons will ever be transported across this bridge. Therefore, it is not anticipated that the risk of spillage will occur. There was therefore no spillage risk identified as part of the spillage risk assessment

All potential impacts have been identified as imperceptible to slight in the operational phase and as such no long-term mitigation measures are proposed. Construction shall be undertaken in accordance with the measures outlined in the Environmental Operation Plan. There will therefore be a slight residual impact during the construction of the River Suir Sustainable Transportation Bridge. No negative residual impacts on flood risk due to loss of conveyance or storage are anticipated at the river crossing. The design for the River Suir Sustainable Transportation Bridge is considered to be conservative and therefore avoids any conveyance capacity issues. The recommended mitigation measures will negate potential risk of flooding at the north and south quays.

11.0 Landscape and Visual

The effect of the proposed bridge on the erosion and sediment regime will be small and highly localised, the effective change in scour patterns will be insignificant in comparison to the existing erosion and sediment transport patterns. The residual impact to surface water morphology is anticipated to be slight as all practicable mitigation measures are to be implemented.

The site of the proposed bridge spans from Waterford's North Quays to the South Quays where it will land on Meagher's Quay near the Clock Tower. This is a city centre site, with a strong urban character on the south side. The buildings facing onto the south quays are generally commercial and of 3 to 4-storey height, occasionally reaching 6-storey.

The northern side was an industrialised port until the 1990s and is now predominantly disused and semi-derelict in visual terms. The disused industrial buildings and wharves have been demolished while the rail lines remain on the waterfront, with dual carriageway road (Dock Road) above retaining walls to the north, with the land rising steeply up from the river level. Residential developments of a suburban character are located to the north and east of the North Quays, and Waterford (Plunkett) Railway Station is to the west of the North Quays SDZ lands. Such developments are elevated above the roadway and the North Quays.

The width of the bridge deck is constant over the bridge extents with the exception of the portions over the two central pier support locations where resting/viewing points have been introduced and the bridge widens out locally over the arches. These are asymmetrical in form, with one facing northwest towards Rice Bridge and the other looking south-east towards the quays and estuary downriver. The five span bridge deck has been laid out symmetrically and comprises a 70m long central span (32.5m wide opening section with a 25m wide navigable channel), two intermediate spans of 41m and two end spans of 27.5m length. There are four piers in total, which provides a symmetrical arrangement across the river channel. The proposed bridge will be relatively low to the water and will not block any existing views but will form a new element in the landscape and views along the river from the city, quays and surrounding residential areas. Due to the quality of design and materials of the proposed bridge, and the fact that bridges, both new and old, are often perceived positively in the landscape (such as the N25 Waterford Suir Bridge, the M1 Boyne Bridge, etc.), it is considered that the bridge will create a positive element in views of the river Suir and the cityscape.

New views from the bridge will also be opened up to pedestrians and users of sustainable transport. It will also add to the pedestrian permeability of the city and therefore enhance the experience of the city's landscape. A new public open space on the South Quays is also proposed which centres on the Clock Tower and provides a more suitable space for the tower than the existing car parking which will be removed and replaced with paved areas and green open space with trees and planting. This is also considered to be a positive impact of the scheme.

During construction stage, the effects on the receptors during construction will be associated with the visibility of the construction activities, cofferdams, piling rigs, cranes and other plant and machinery. The visual impacts are considered to be moderate and negative for all receptors due to the visibility of construction activities however the duration will be short term.

12.0 Noise and Vibration

A variety of items of plant will be in use for the purposes of site clearance and construction of the proposed development. There will be vehicular movements to and from the site that will make use of existing roads, and due to the nature of construction activities, there is potential for the generation of elevated levels of noise. Excavator mounted breakers will be employed to remove existing concrete and rock and then standard construction tools and methods will be employed for general construction and landscaping.

Indicative noise levels have been predicted using guidance set out in BS 5228-1:2009+A1:2014 for the main phases of the proposed construction works. The calculations assume common equipment used for each activity along with estimates of percentage on times for which the equipment will operate during the 12-hour working day.

The predicted exceedances are due to noise emissions from concrete breaking and piling activities. Piling is expected to take place at a range of distances from the sensitive receptors with the noisiest part of the piling process only occurring for a relatively short period in comparison with the entire programme. Giving consideration to the predicted construction noise levels, it is recommended that the various best practice working methods used to control noise and vibration are adopted by the contractor during all works.

Vibratory piling works will be carried out at the south abutment and at the sheet piling for the temporary cofferdams. The closest receptor to the vibratory piling works is estimated to be approximately 50m distance and the Clock Tower is estimated to be approximately 30m from the vibratory piling works. It is expected that the contractor will ensure that all best practice noise and vibration control methods will be used as necessary in order to ensure impacts to nearby residential noise sensitive locations are not significant. Noise-related mitigation methods will be implemented for the project in accordance with best practice. Vibration monitoring will be undertaken at the Clock Tower during construction works in order to ensure compliance with thresholds.

During the operational phase of the development, the potential sources of noise and vibration are limited to occasional use of mechanical plant required to operate the bridge opening mechanism and the movement of cyclists, pedestrians and an electric bus across the bridge. The mechanical plant required to open the bridge will be controlled in accordance with BS 4142 such that the existing noise environment is not increased.

During the construction phase of the project there is the potential for impacts on nearby noise sensitive properties due to noise emissions from site activities. The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impacts will be reduced as far as is reasonably practicable. The resultant residual noise impact from this source will be of negative, significant, short-term impact.

During the operational phase it is expected that noise emissions from the Sustainable Transport Bridge will not be perceptible above the existing noise environment resulting in a neutral, imperceptible, long-term impact.

13.0 Air Quality and Climate

The Institute of Air Quality Management (IAQM) guidelines (IAQM 2014) for assessing the impact of dust emissions from construction and demolition activities have been used in this assessment based on the scale and nature of the works and the sensitivity of the area to dust impacts. In terms of receptor sensitivity, the area is characterised as having mostly medium sensitivity receptors with a small number of high sensitivity receptors within the area of the site. In terms of the south-westerly prevailing wind, the area downwind of the site is a high sensitivity environment (residential properties on Dock Road). However, as these receptors are situated up a hill from the proposed site the potential impact is reduced. The results of the construction phase air quality and climate assessment have shown that, with appropriate mitigation measures in place, residual impacts of the proposed development on air quality and climate for the long- and short-term will be negligible.

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Dust emission magnitude from earthworks can be classified as small, medium and large and are described below.

The dust emission magnitude for the proposed earthwork activities can be classified as small. This results in an overall negligible risk of temporary dust soiling impacts, low risk of ecological impact and an overall negligible risk of temporary human health impacts as a result of the proposed earthworks activities. The dust emission magnitude from trackout activities is classified as medium. This results in an overall low risk of temporary dust soiling impacts, low risk of ecological impact and an overall low risk of temporary human health impacts as a result of the proposed trackout activities. Overall, in order to ensure that no dust nuisance occurs during the earthworks and trackout activities, a range of dust mitigation measures associated with a medium risk of dust impacts will be implemented. When the dust mitigation measures outlined for the proposed development are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

The nature of the development is such that there is no predicted impact on traffic, beneficial or adverse. Therefore, using the DMRB screening criteria, no road links can be classed as 'affected' by the proposed development and do not require inclusion in the local air quality assessment.

The overall results of the air quality and climate assessment have shown that, with appropriate mitigation measures in place, short and long-term residual air quality and climate impacts of the proposed development will be negligible.

14.0 Archaeological and Cultural Heritage

Waterford has a rich cultural heritage associated with the River Suir, with the foundation of Waterford as a city dating back to the Viking Age and the earliest date for the city itself being generally accepted around AD 912-33. Waterford began as a defended Viking longphort or ship-fortress and became Ireland's second city after Dublin.

The proposed bridge is to be located to the north west of the 'Viking Triangle' (as now defined). No direct or indirect impacts to any recorded features of terrestrial or underwater archaeological or historic significance are anticipated as part of the proposed development. However, groundworks may have a direct negative impact on any previously unrecorded archaeological features, deposits or artefacts which have the potential to survive beneath the modern quay structures or in the estuarine silts of the riverbed. This would be caused by excavation and removal of materials to facilitate the construction of bridge piers/landings etc.

It is recommended that removal of any quayside masonry or furniture should be carried out under archaeological monitoring to facilitate further recording. It may be deemed appropriate to retain and reuse any elements of particular cultural heritage significance as part of the development and these can be identified during archaeological monitoring.

The riverbed surrounding Piers D and E will be enclosed within cofferdams as part of the construction process. The cofferdams are to be dewatered as part of that process; it is recommended that an additional archaeological inspection of the riverbed within the footprint of the cofferdam is undertaken prior to construction.

Photogrammetry of the stone quay at the North Quay landing point of the proposed development should also be undertaken in advance of the commencement of construction works. The photogrammetry survey should be annotated and a record should be made of the section of quay wall being removed.

15.0 Architectural Heritage

All excavation works should be archaeologically monitored by experienced, licensed underwater archaeologists with a proven track record in equivalent, similar type work. Should archaeological material, wreckage, timbers or other artefacts be recorded in the course of the monitoring, the archaeologist will be empowered to recover and record the material. This may involve the temporary suspension of the work to recover the material. In the event that excavation works impact on an archaeological site, the standby archaeological dive team, in place for such eventualities, should be mobilised to undertake a dive inspection of the impacted site which may lead to further investigations and / or potentially full excavation.

The city of Waterford has its origins in Viking times, when the city stretched along the waterfront between Barronstrand Street and The Mall. Following the arrival of the Normans the city expanded westwards, presenting a longer frontage to the river. By the mid-eighteenth century the quays stretched along the full length of the city's river frontage, from Reginald's Tower and The Mall in the east, to the Graving Bank in the west, around the site of the present Grattan Quay.

Protected structures within the vicinity of the bridge have been identified as part of the assessment of Architectural Heritage. These include the Clock Tower and bollards on the South Quays, where the proposed bridge will tie in. The potential for direct and indirect impacts on the architectural heritage of the Waterford Quays has been assessed and mitigation measures proposed for construction stage.

There will likely be positive impacts arising from the facility afforded by the proposed bridge for viewing the significant architectural heritage. In particular, the bridge will provide a good vantage point for views of Edmund Rice Bridge and the approach towards the south quays will highlight the Clock Tower direction in front of the viewer walking on the bridge. The bridge will also provide good views of the buildings along the frontage of the quays.

Any cut stone removed from the quay wall or the surface of the quay is to be reused in a similar manner or, where this is not possible or appropriate, the stone is to be salvaged and stored for future use elsewhere along the quays. Following mitigation, the expected impact on the character of the quay would be slight.

Mitigation will be required to safeguard the clock tower during the works. The clock tower is to be excluded from the working area and the hoarding surrounding the working area is to be located outside the ring of post-and-chain fencing around the northern, eastern and western sides of the tower.

Prior to the commencement of works and prior to the erection of the site hoarding a detailed photographic record of the clock tower is to be made showing both the interior and the exterior of the tower. A report based on this photographic survey is to be prepared and lodged with the Conservation Officer, with a copy also lodged with the Waterford City and County Libraries Central Library.

Prior to the commencement of the works on the quays a vibration monitor is to be set up within the clock tower and this is to have the facility to send an alarm to a designated engineer in the event of the vibrations within the tower exceeding a predetermined limit to be set by the engineer at a level below which any damage to the tower through vibration is likely to occur.

16.0 Material Assets and Land

Waterford City is the largest urban area in the South East of Ireland and is an important tourism centre with good transport linkages for both public and private transport. The construction of the proposed sustainable transport bridge will potentially increase the walking catchment from the City Centre to the areas north of the River Suir to include a population of approximately 4,000 people, and the cycling catchment to include 7,400 people, in line with the NPF which predicts a future population of 30, 000 people on north side of the River Suir. It is expected that the proposed bridge may carry approximately 4 million users annually.

It is considered that the proposal will have limited adverse impacts during the construction phase which is, by its nature, temporary. The permanent removal of 150 car parking spaces from the South Quay and the removal of approximately 140m^2 of berthing facility from Pontoon C are considered the most significant permanent impacts associated with the project. In contrast, the operation of the development will provide many significant positive impacts to the city and wider region. Specific significant positive impacts relating to the operational phase of the proposal include:

- Providing alternative sustainable transport options including cycling, walking and public transportation along a safe and secure route which is segregated from private vehicles;
- Providing indirect health benefits through the provision of safer facilities for recreational users which will increase and encourage the opportunity for physical exercise;
- Providing connectivity to the proposed transport hub on the north quay, including the relocated train station;
- Providing a new amenity for Waterford City, thereby enhancing the attractiveness of the city to tourism and increasing the economic potential of the city;
- Providing linkages and connectivity, thereby enabling the concentric development of the city which, when realised, will act as an economic driver for the region. Aiding integration of the SDZ with Waterford City and the integration of the North Quay and the South Quay. Aiding integration of the existing Waterford Greenway and the proposed New Ross to Waterford Greenway and aiding integration of the Ferrybank area, particularly schools on Abbey Road, with Waterford City; and
- Providing positive impacts on material assets due to enhanced accessibility and attractiveness of the area which in turn will maintain commercial and residential rents and property values.

17.0 Major Accidents, Interrelationships and Cumulative Impacts

The EIAR has assessed the vulnerability of the proposed development to risks of major accidents and/or disasters, in addition to identifying any interrelationships that may occur between individual topics, and cumulative impacts which may occur as a result of other projects within the area. These are summarised below.

Major Accidents and Natural Disasters

There are no "Seveso" sites (establishments within the meaning of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015) in close proximity to the proposed development. The closest establishment is at least 1km east of the proposed development. The design of the proposed development has taken account of the potential for flooding and it is considered that there is minimal flood risk as a result of the proposed development. In relation to accidents resulting in a spillage of polluting material, the risk of these occurring will be significantly reduced and if a spillage should occur the proposed development incorporates drainage to allow the spilled material to be contained and treated prior to discharge.

Interrelationships

The interrelationships between the individual environmental disciplines have been considered and assessed. It is concluded that once relevant mitigation measures are implemented, no residual likely significant effects will exist as a result of the construction or operation of the River Suir Sustainable Transport Bridge.

Cumulative Impacts

It is considered that the scale of the works and implementation of effective environmental control measures will avoid all likely significant effects on environmental parameters. There is no potential for cumulative impacts arising in combination with any other plans or projects and therefore no potential for in-combination effects on environmental parameters.

Based on the above, it can be objectively concluded, in view of best scientific knowledge, on the basis of objective information and provided effective mitigation is in place, that the Project, individually or in combination with other plans and projects, will not have a significant adverse effect on the receiving environment.

18.0 Further Information & What Happens Next

The Environmental Impact Assessment Report (EIAR) will be available for inspection at the following locations as detailed in the published newspaper notices:

- Waterford City and County Council, Customer Care Desk, Baileys New Street, Waterford City (Office Hours 9:30am-4:00pm Monday to Friday) and
- Waterford City and County Council, Civic Offices, Davitt's Quay, Dungarvan, Co. Waterford (Office Hours 9:30am-4:00pm Monday to Friday).

A copy of the EIAR and/ or the Natura Impact Statement (NIS) may be purchased on payment of the following fees:

Document	Title	Printed	Electronic (DVD)
EIAR Volume 1	Non-Technical Summary	€5	€5
EIAR Volume 2	EIAR Text	€25	
EIAR Volume 3	EIAR Figures	€50	
NIS	Natura Impact Statement	€25	

A copy of the EIAR and NIS may also be accessed free of charge on the Council's website at **www.waterfordcoco.ie**

Submissions may be made in writing to:

An Bord Pleanála,
Strategic Infrastructure Division,
64 Marlborough Street,
Dublin 1, D01 V902.

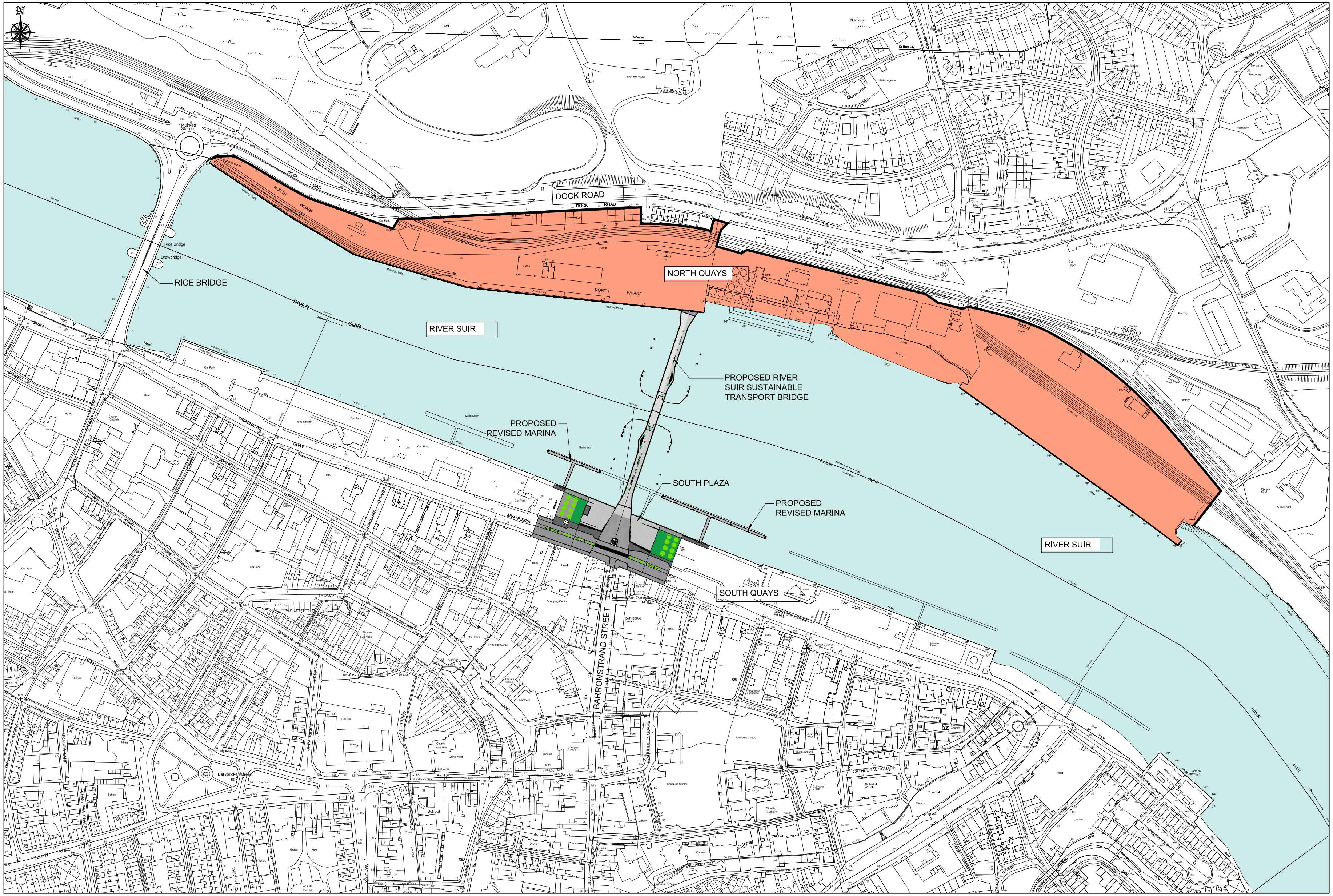
Submissions may be made prior to the dates specified in the published newspaper notices, in relation to:

- the likely effects on the environment as a result of the River Suir Sustainable Transport Bridge;
- the implications of the River Suir Sustainable Transport Bridge for proper planning and sustainable development in the area which it is proposed to situate the proposed development; and
- the likely significant effects of the River Suir Sustainable Transport Bridge on a European Site.

An Oral Hearing may be held, should the statutory requirements for one be met. Written submissions, together with any representations made at any oral hearing, will be considered by An Bord Pleanála in making its decision on whether or not to approve the River Suir Sustainable Transport Bridge with or without modifications. An Bord Pleanála's decision will be published in one or more newspapers circulating in the area, including where appropriate, particulars of any modifications to the River Suir Sustainable Transport Bridge.

NON-TECHNICAL SUMMARY

Figures



LEGEND:

STRATEGIC DEVELOPMENT ZONE

Comhairle Cathrach & Contae Phort Láirge
Waterford City & County Council

No.	Revision	Date	By	Chk'd	App'd
	Stage		Date		App'd
	PRELIMINARY				
	APPROVAL				
	TENDER				
	CONSTRUCTION				

ROD
ROUGHAN & O'DONOVAN
Consulting Engineers
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Fax : +353 1 294 0820
e-mail : info@rod.ie
Website : www.rod.ie

Project Title: RIVER SUIR SUSTAINABLE TRANSPORT BRIDGE

Drawing Title: EXTENT OF SITE

Designed: EP	Checked: CS	Approved: TD	Status: E.I.A.R

Drawn: OB	Job No: 16.169	Drawing No: NTS 1	Rev: -
Scale: (A1) 1:1500 - (A3 1: 3000)	Date: JUL '18		

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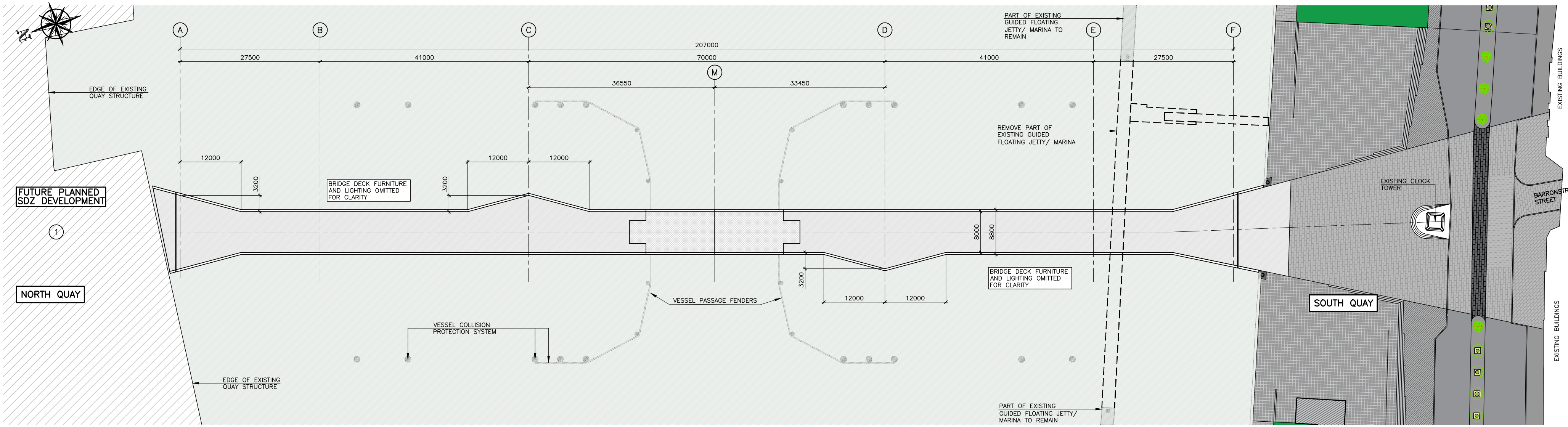
DO NOT SCALE USE FIGURED DIMENSIONS ONLY



BRIDGE PLAN

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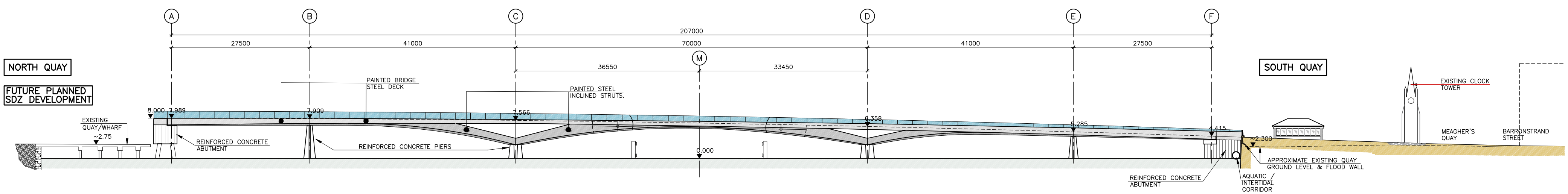

BRIDGE ELEVATION – CLOSED POSITION

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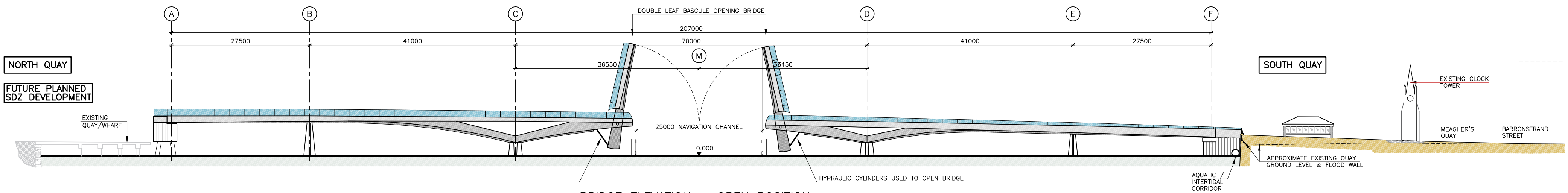

BRIDGE ELEVATION – OPEN POSITION

SCALE 1:400

Comhairle Cathrach & Contae Phort Láirge
Waterford City & County Council

No.	Revision	Date	By	Chk'd	App'd
-					

Stage	Date	App'd
PRELIMINARY		
APPROVAL		
TENDER		
CONSTRUCTION		

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Designed: DC / EP | Checked: CS | Approved: TD | Status: E.I.A.R

Project Title: RIVER SUIR SUSTAINABLE TRANSPORT BRIDGE

Drawing Title: BRIDGE PLAN, VERTICAL ALIGNMENT & ELEVATION

Drawn: PE | Job No: 16169 | Drawing No: NTS 2 | Rev: -

Scale: (A1) AS SHOWN | Date: OCT '18

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Waterford City & County Council

No.	Revision	Date	By	Chk'd	App'd
	Stage		Date		App'd
PRELIMINARY					
APPROVAL					
TENDER					
CONSTRUCTION					

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Website : www.rod.ie

Project Title: RIVER SUIR SUSTAINABLE TRANSPORT BRIDGE

Drawing Title: SOUTH QUAY PLAZA PLAN

Designed: JB	Checked: CS	Approved: TD	Status: E.I.A.R	Drawn: JMK	Job No: 16.169	Drawing No: NTS 3	Rev: -
				Scale: (A1) 1:250 - (A3 1: 500)	Date: OCT '18		

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Main Text
Volume 2

Chapter 1
Introduction

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 1 Introduction

1.1 General

This Environmental Impact Assessment Report (EIAR) for the proposed River Suir Sustainable Transport Bridge is *"A statement of the effects, if any, which the proposed project, if carried out, would have on the environment"* (Environmental Protection Agency (EPA), Draft 2017) and has been prepared in respect of the construction and operation of the proposed development. The EIAR, as presented, has been prepared by Roughan & O'Donovan (ROD) consulting engineers and a team of specialist sub-consultants, with the assistance of Waterford City and County Council.

The EIAR is presented in three volumes; the standalone Non-Technical Summary is Volume 1, this Volume 2 contains the main text and Volume 3 contains the associated Figures. Volume 2 comprises Background Information and General Description (Chapters 1-4) and Environmental Effects and Proposed Mitigation Measures (Chapters 5-18). A separate Natura Impact Statement (NIS) which complements the EIAR, and vice versa, has also been prepared. The volume and chapter layout of this EIAR is hereby presented:

Volume 1: Non – Technical Summary

Volume 2: Main Text

Chapter	1:	Introduction
Chapter	2:	Need for the Proposed Development
Chapter	3:	Alternatives Considered
Chapter	4:	Description of the Proposed Development
Chapter	5:	Traffic and Transport
Chapter	6:	Population and Human Health
Chapter	7:	Biodiversity
Chapter	8:	Soils and Geology
Chapter	9:	Hydrogeology
Chapter	10:	Hydrology
Chapter	11:	Landscape and Visual
Chapter	12:	Noise and Vibration
Chapter	13:	Air Quality and Climate
Chapter	14:	Archaeological and Cultural Heritage
Chapter	15:	Architectural Heritage
Chapter	16:	Material Assets and Land
Chapter	17:	Major Accidents, Interrelationships and Cumulative Impacts
Chapter	18:	Mitigation Measures

Volume 3: Figures

1.2 Overview

1.2.1 Proposed Development

The proposed development comprises a sustainable transport bridge crossing the River Suir in Waterford City and includes a paved and landscaped plaza at the landing point on the South Quay, in direct proximity to the Clock Tower. It is anticipated that the proposed bridge will provide a new pedestrian, cycle and courtesy electric bus link between the North Quays and South Quays, promoting the further development of Waterford City and facilitating the development of the North Quays Strategic Development Zone (SDZ) lands. The proposed development is termed a 'Sustainable Transport Bridge' as it will support sustainable modes of transport including pedestrians, cyclists and electric bus users. The bridge will be approximately 207m in length and will allow the extension of the retail spine from Waterford City across to the North Quays SDZ.

On the South Quay the proposed bridge will land in the vicinity of the Clock Tower on Meagher's Quays. The South Quay setting currently comprises at-grade car parks which are adjacent to Merchant's Quay (R680), a 19th century Clock Tower and associated bollards, a walkway along the river edge and a glass walled flood defence. A marina is also located within the River Suir at this point with access at one point via the adjoining car park.

During the 13th to 16th centuries, Waterford accounted for a large portion of Ireland's trade and the South Quay was a focal point for this trade. The South Quay was reconstructed in the early 18th century, which allowed for trade with North America, England and the Continent. A bridge was built across the River Suir in 1793, improving communications with the hinterland to the north, which had up until then been cut off from the city to the south.

The North Quays at present comprise an assembly of wharves consisting of disused open spaces following the demolition of disused industrial buildings in 2016 and the Hennebique grain store building in July 2018. The Rosslare to Waterford (via Belview) rail line terminates to the east of the North Quay landing point.

Rice Bridge is currently the only crossing of the River Suir within Waterford City centre. The current pedestrian access from the north quays to the south quays entails walking upriver along Dock Road, crossing Rice Bridge to the south quays and walking along Merchant's Quay (R680), as presented in Plate 1.1. While there are cycle lanes along Merchant's Quay in both directions, there are no cycle facilities provided along Dock Road or Rice Bridge and it is a hostile environment for cyclists, as presented in Plate 1.2. The Ferrybank and Bellfield areas are residential areas to the north of Waterford City with limited connectivity to Waterford City other than by car or bus.

Plate 1.1 **Existing access route for pedestrians between the North and South Quays, along Dock Road (R711), Rice Bridge and Merchant's Quay (R680) (Courtesy of Google Maps)**

Plate 1.2 **Traffic on the Plunkett Station roundabout, looking east showing the absence of cycle lanes**

1.2.2 EIAR Team

Roughan & O'Donovan have led the preparation of this EIAR with the assistance of a number of specialists. Table 1.1 outlines the experience and qualifications of these experts.

Table 1.1 Experience and Qualifications of the EIAR Contributors

Topic	Specialist Contributors	Company	Qualifications	Experience (Years)
Chapters 1-4	Barry Corrigan	ROD	BSc, Dip EIA & SEA, MIEMA, CEnv	18
	Tony Dempsey	ROD	B.A., BA.I (Civil), Ph.D. C.Eng. M.I.E.I.	25
	Christian Smith	ROD	BEng Civil, CEng	17
	Christine Murphy	ROD	BSc, MSc Env Sci, PIEMA	6
	Daniel Coleman	ROD	BEng, MEng, CEng	6
	Edoardo Po	ROD	MEng MIE., PGrad Dip, CEng	5
Traffic and Transport	John Bell	ROD	BEng, CEng	17
Population and Human Health	Frances O'Kelly	ROD	BSc, MSc	11
	Warren Vokes	ROD	BA, MSc	3
Biodiversity	Owen O'Keefe	ROD	BSc, ACIEEM	3
	Kate Moore	ROD	BSc, GradCIEEM	2
	Brendan O'Connor	Aquafact	Ph. D., B.Sc. Hons	38
Land and Soils	Fintan Buggy	ROD	BSc, MSc Soil Mechanics, CEng, MICE, PE MIEI	36
Hydrogeology	Patrick Morrissey	ROD	BA, BAI, MSc, PhD, PGDip Stats, MIEI	10
Hydrology	Tony Cawley	Hydro Environmental	BE(Civil), MSc.Eng Hydrology;	31
	Patrick Morrissey	ROD	BA, BAI, MSc, PhD, PGDip Stats, MIEI	10
	Warren Vokes	ROD	BA, MSc	3
Landscape and Visual	Mark Boyle	Murray & Associates	BSc. Ag., M Landscape Architecture, Dip Project Management	20
Noise and Vibration	Dr Stephen Smyth	AWN Consulting Ltd.	BA, BAI, MIEI, MIOA	14
	Alistair Maclaurin	AWN Consulting Ltd.	Dip. Acoustics & Noise Control, Acoustics	12
Air Quality and Climate	Dr Ed Porter	AWN Consulting Ltd.	BSc, PhD Chem, MRSC	20
	Dr Avril Challoner	AWN Consulting Ltd.	BEng Env.Eng. HDip Statistics, PhD Env Chemistry	6

Topic	Specialist Contributors	Company	Qualifications	Experience (Years)
Archaeology and Cultural Heritage	Faith Bailey	Irish Archaeology Consultancy (IAC)	MA BA (Hons), MCIFA, MIAQM	14
Underwater Archaeology	Julianna O'Donoghue	Mizen Archaeology	BSc Archaeology	17
Architectural Heritage	Rob Goodbody	Historic Building Consultants	BA(Mod); Dip Environmental Planning; MA Local History; Masters in Urban and Building Conservation; Dip Applied Building Repair & Conservation	43
Material Assets and Land	Barry Corrigan	ROD	BSc, Dip EIA & SEA, MIEMA, CEnv	18
	Christine Murphy	ROD	BSc, MSc Env Sci, PIEMA	6
	Gemma Rothwell	ROD	BSc Env Sci	2
Major Accidents, Interrelationships and Cumulative Impacts	Christine Murphy	ROD	BSc, MSc Env Sci, Dip Env Law, PIEMA	6
	Gemma Rothwell	ROD	BSc Env Sci	2
Mitigation Measures	Christine Murphy	ROD	BSc, MSc Env Sci, PIEMA	6

1.2.3 Constraints Study

A Constraints Study (file reference number 002_2016.10.04_WCCC) was carried out and published in October 2016. The Constraints Study was a desktop review of publicly available information to identify potential significant environmental constraints relating to the proposed development prior to the commencement of the design stage. The report highlighted key constraints and recommended necessary surveys and assessments.

1.3 EIA Legislation

1.3.1 Introduction

Environmental Impact Assessment (EIA) is defined in Directive 2011/92/EU (as amended by Directive 2014/52/EU) as follows:

"Environmental Impact Assessment means a process consisting of:

- *(i) the preparation of an environmental impact assessment report by the developer, as referred to in Article 5(1) and (2);*
- *(ii) the carrying out of consultations as referred to in Article 6 and, where relevant, Article 7;*
- *(iii) the examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the developer in accordance with*

Article 5(3), and any relevant information received through the consultations under Articles 6 and 7;

(iv) the reasoned conclusion by the competent authority on the significant effects of the project on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination; and

(v) the integration of the competent authority's reasoned conclusion into any of the decisions referred to in Article 8a."

1.3.2 Legal Requirement for an EIAR

This EIAR has been prepared in accordance with the relevant provisions of Directive 2011/92/EU[1] on the Assessment of the Effects of Certain Public and Private Projects on the Environment as amended by Directive 2014/52/EU[2]2. Directive 2014/52/EU amends EIA law in a number of respects by amending Directive 2011/92/EU. Article 5 and Annex IV to the EIA Directive 2011/52/EU, (as substituted by Directive 2014/52/EU) and Sections 50(2) and 50(3) of the Roads Act 1993, as amended, specify the information to be contained in an EIAR (referred to as an Environmental Impact Statement (EIS) in Roads Act 1993, as amended) in relation to this proposed development. Directive 2014/52/EU was required to be transposed by 16 May 2017 and requires changes in Irish laws, regulations and administrative provisions across a number of legislative codes to reflect the contents of Directive 2014/52/EU. On the 1st September 2018, the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) came into operation in order to transpose the requirements of Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment into Irish planning law. However, at the time of publication of this EIAR, the changes in Irish laws across a number of legislative codes (including the Roads Act 1993 as amended and Road Regulations 1994 as amended) have not yet been implemented. This EIAR has been prepared in full accordance and compliance with the provisions of Directive 2014/52/EU. Regard has also been had to the current provisions of the relative Irish legislative codes including the Roads Act 1993 as amended as they continue to apply at this time.

Section 50 of the Roads Act (1993 - 2015), as amended, sets out provisions for the preparation of an EIAR.

Section 50(1) of the Roads Act (1993-2015) states (Note: The functions of the Minister have transferred to An Bord Pleanála under Section 215 of the Planning and Development Act 2000, as amended):

"1 (a) A road authority or the Authority shall prepare a statement of the likely effects on the environment ('environmental impact statement') of any proposed road development it proposes consisting of -

(i) the construction of a motorway,

(ii) the construction of a busway,

(iii) the construction of a service area, or

(iv) any prescribed type of proposed road development consisting of the construction of a proposed public road or the improvement of an existing public road."

[1] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification).

[2] Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.

(b) *Where the Minister considers that any proposed road development (other than development to which paragraph (a) applies) consisting of the construction of a proposed public road or the improvement of an existing public road would be likely to have significant effects on the environment, he shall direct the road authority to prepare an environmental impact statement in respect of such proposed road development and the authority shall comply with such direction*

(c) *Where a road authority considers that any proposed road development (other than development to which paragraph (a) applies) consisting of the construction of a proposed public road or the improvement of an existing public road would be likely to have significant effects on the environment, it shall inform the Minister in writing and where the Minister concurs with the road authority he shall give a direction to the road authority under paragraph (b)."*

The prescribed type of proposed road development, as defined by paragraph 8 of the Roads Regulations (Statutory Instrument (SI) No.119 of 1994), for the purpose of subsection (1) (a) (iv) of Section 50 of the Act is as follows:

"(a) the construction of a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road would be eight kilometres or more in length in a rural area, or 500 metres or more in length in an urban area;

(b) ***the construction of a new bridge or tunnel which would be 100m or more in length****."*

Taking this legislation into account, the proposed River Suir Sustainable Transport Bridge requires that an EIAR is prepared under the Roads Regulations (SI. No. 119 of 1994) subsection (1) (a) (iv) (b) of Section 50 as the proposed development comprises the construction of a new bridge of 207m in length, exceeding the prescribed length of 100m. The proposed development exceeds the threshold for which an EIA is automatically required.

1.4 Scope of the EIAR

The design of a development is a systematic and iterative process in which the collation and assessment of environmental data and predicted impacts are essentially linked to the development of the design. Chapter 3, Alternatives Considered, of this EIAR summarises the processes that led to the development of the proposal that is described in Chapter 4, Description of the Proposed Development.

The process of EIA Scoping for this EIAR and an Informal EIA Scoping document was issued to statutory consultees in June 2017, requesting comments on the proposed content of the EIAR.

1.4.1 Environmental Protection Agency (EPA) Guidelines

The following EPA guidelines informed the EIAR:

- EPA, Guidelines on the Information to be contained in Environmental Impact Statements, 2002; and
- EPA, Advice notes on Current Practice (in the preparation of Environmental Impact Statements), 2003; and
- Advice Notes for Preparing Environmental Impact Statements, Draft September 2015.

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft May 2017 is currently on consultation and has been considered in informing the EIAR.

1.4.2 Transport Infrastructure Ireland (TII) / National Roads Authority (NRA) Environmental Assessment and Construction Guidelines

The following NRA (now known for operational purposes as TII) planning guidelines were considered during the design and environmental assessment processes:

- Environmental Impact Assessment of National Road Schemes - A Practical Guide, Revision 1, 20 November 2008;
- Guidelines on the Implementation of Landscape Treatments on National Road Schemes in Ireland, 2012;
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, Revision 1, May 2011;
- Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes, 2006;
- Guidelines for Assessment of Ecological Impacts of National Road Schemes, Revision 2, 1st June 2009;
- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes, 2008;
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Scheme, 2008;
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes - Revision 1, October 2004;
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, March 2014;
- Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes, 2005; and
- Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, 2005.

The following TII / NRA construction guidelines are followed and referred to during the environmental assessment process:

- Guidelines for the Management of Noxious Weeds and Non- Native Invasive Plant Species on National Roads, Revision 1, December 2010;
- The Management of Waste from National Road Construction Projects, December 2017;
- Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes, July 2008;
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, during and Post Construction of National Road Schemes, 2006;
- Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes - Revised November 2006;
- Guidelines for the Treatment of Badgers during the Construction of National Road Schemes, 2005;
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes, 2006;

- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes, 2008; and
- Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan, 2007.

1.5 Difficulties Encountered

There were no particular difficulties encountered in the development of this EIAR.

It should be noted that surveys, assessments and information that form the basis of this EIAR are based on the current design of the proposed development which has been developed to a stage that permits a fully informed EIA. While some developments and refinements of the current design may occur during the detailed design stage, any such iterations of the development, if approved, will not include any significant adverse impacts on the environment not dealt with within this EIAR.

1.6 Statutory Consultations

A copy of this EIAR is being provided to the prescribed bodies as required by Section 51(3) of the Roads Act (1993), as amended. The EIAR and NIS will be available for inspection until 12th of February 2019 at the following locations as detailed in the published newspaper notices:

- Waterford City and County Council, Customer Care Desk, Baileys New Street, Waterford City (Office Hours 9:30am-4:00pm Monday to Friday) and
- Waterford City and County Council, Civic Offices, Davitts Quay, Dungarvan, Co. Waterford (Office Hours 9:30am-4:00pm Monday to Friday)

Copies of the full EIAR and/or NIS may be purchased from Waterford City and County Council offices. Alternatively, the EIAR can be viewed on the Waterford City and County Council website at www.waterfordcouncil.ie.

In addition to the statutory consultations, a non-statutory consultation was held in Waterford City in July 2018 during the development of the design of the proposed development. The feedback received during the consultation process was considered by the project team in the development of the design and in the preparation of this EIAR. The alternative bridge options are discussed in Chapter 3.

Chapter 2
Need for the Proposed Development

ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 2 Need for the Proposed Development

2.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) details the need for the proposed River Suir Sustainable Transport Bridge, as outlined in current planning policy. This introductory section provides an overview of the key policies which support the proposed development. These policies are then described in detail in Section 2.2.

2.1.1 Need for the Scheme

The need to improve access to sustainable transport options and encourage walking and cycling is set out in European, national and regional planning policy. Set in this wider policy context, the need for the River Suir Sustainable Transport Bridge is specifically identified in Ireland 2040 Our Plan (2018), The Waterford North Quays Strategic Development Zone (SDZ) Planning Scheme (2018), Waterford City Development Plan (2013-2019), Waterford Planning, Land Use and Transportation Study (2004), and the Waterford North Quays Urban Design Framework Plan (2008). The proposed development will form a sustainable transport link over the River Suir, connecting Waterford City Centre with the Waterford North Quays SDZ and the Ferrybank area.

2.1.2 Existing Scenario

Development in Waterford City is currently primarily focused on the south side of the River Suir, with Rice Bridge being the only crossing of the River Suir in Waterford City centre. The North Quays comprise an assembly of wharves consisting of disused open spaces. A view towards the south from the North Quays is presented in Plate 2.1. The North Quays were designated as a SDZ by the Minister for the Environment, Heritage and Local Government in 2016 and a Planning Scheme was published and adopted by Waterford City and County Council in 2018. The Planning Scheme sets out a vision for the redevelopment of the North Quays and objectives with which future planning applications for the SDZ must be compliant.

Plate 2.1 Current view of the proposed bridge location from the North Quays SDZ looking south

2.2 Policy Background

2.2.1 General

The need for the River Suir Sustainable Transport Bridge has been identified in, and/or is consistent with, the following European, national, regional and local planning policy documents:

European Policy Context

- European Union (EU) Cycling Strategy, 2017; and
- EuroVelo.

National Policy Context

- Ireland 2040 Our Plan, National Planning Framework, 2018;
- The National Spatial Strategy, 2002 – 2020;
- Smarter Travel: A Sustainable Transport Future, 2009 – 2020;
- National Cycle Policy Framework, 2009-2020;
- Building on Recovery - Infrastructure and Capital Investment, 2016 – 2021;
- Investing In Our Transport Future: A Strategic Framework For Investment in Land Transport; and
- Project Ireland 2040, National Development Plan, 2018-2027.

Regional Policy Context

- Regional Planning Guidelines for the South East Region, 2010-2022;
- The Southern and Eastern Regional Operational Programme, 2014-2020; and
- The South East Economic Development Strategy (SEEDS), 2013-2023

Local Policy Context

- Waterford North Quays Strategic Development Zone Planning Scheme, 2018;
- Waterford City Development Plan, 2013-2019;
- Waterford County Development Plan, 2011-2017;
- Waterford Planning, Land Use and Transportation Study (PLUTS) 2004;
- Waterford North Quays Urban Design Framework Plan, 2008;
- Ferrybank – Bellview Local Area Plan, 2017;
- Kilkenny County Development Plan, 2014-2020;
- Waterford City Centre Urban Renewal Scheme, 2015;
- Economic Strategy for Waterford City and County, 2013; and
- One Waterford: Local Economic & Community Plan, 2015-2020

2.2.2 European Policy Context

EU Cycling Strategy, 2017

The EU Cycling Strategy consolidates a systematic review of all EU policies related to cycling, reviewing the current state of cycling in the European Union and providing a cycling implementation plan including recommendations addressed to the European level, complemented by recommendations to the national and regional/local level.

These regional and local level recommendations include:

- Develop and maintain regional and local cycle route networks;
- Develop safe cycle routes to schools, city centres and business areas;
- Segregate cyclists from other traffic where there is high speed/high volume motorised traffic, or otherwise create safe conditions on roads where cyclists mix with motorised vehicles;
- Develop and maintain national cycle route networks;
- Develop and maintain regional and local cycle route networks; and
- Develop the current and future industrial areas, as well as good connections with harbours and other transport modes.

In achieving a shift in mobility culture, the strategy requires EU cities to convince decision-makers to support cycling; encourage people to cycle more; and facilitate the cooperation among road users for safer cycling.

The strategy includes four central objectives for the timeframe of the document:

- Grow cycle use by 50% at an average across the EU;
- Halve rates for killed and seriously injured cyclists (in km cycled);
- Invest €3 billion in cycling in the period 2021 – 2027, and €6 billion from 2028 – 2034; and
- At a qualitative level, it is strongly advised that cycling is treated as an equal partner in the mobility system.

The provision of a sustainable transport bridge connecting to the Rosslare Greenway will support and contribute towards achieving the above regional and local recommendations in addition to contributing towards the four European-wide central objectives within the timeframe of the document.

EuroVelo

EuroVelo is the European cycle route network developed and coordinated by the European Cyclists' Federation (ECF) which is envisaged to be complete by 2020. 14 routes have been outlined, consisting of over 70,000km of cycle routes, connecting the whole continent. The objectives of the EuroVelo are:

- to ensure the implementation of very high quality European-grade cycle routes in all countries of Europe, to carry the best European practice across borders and, as such, harmonise standards;
- to communicate the existence of these routes to decision makers and potential users, to promote and market their use, and to provide an important port of call for information about cycling in Europe; and
- in this way, to encourage large numbers of European citizens to give cycling a try, and in doing so promote a shift to healthy and sustainable travel – for daily trips and cycling tourism.

The EuroVelo Route 1 - Atlantic Coast Route is one of the 14 proposed routes which runs from northern Norway to Portugal and will comprise 9,100km. The proposed development would support this EU goal, providing a link between the developed Waterford Greenway and the developed cycling route with EuroVelo signs through the south coast of Wexford from Rosslare Harbour to Kilmore to Fethard to Ballyhack, as presented in yellow in Plate 2.2.

Plate 2.2 EuroVelo route 'under development' through Waterford and Wexford

2.2.3 National Policy Context

Ireland 2040 Our Plan – National Planning Framework, 2018

The National Planning Framework (NPF) is the Government's plan to cater for the additional people that will be living and working in Ireland and the half a million extra homes that will be needed by 2040. It focuses on growing our regions, cities, towns and villages and rural fabric; building more accessible urban centres of scale; and better outcomes for communities and the environment through more effective and coordinated planning, investment and delivery.

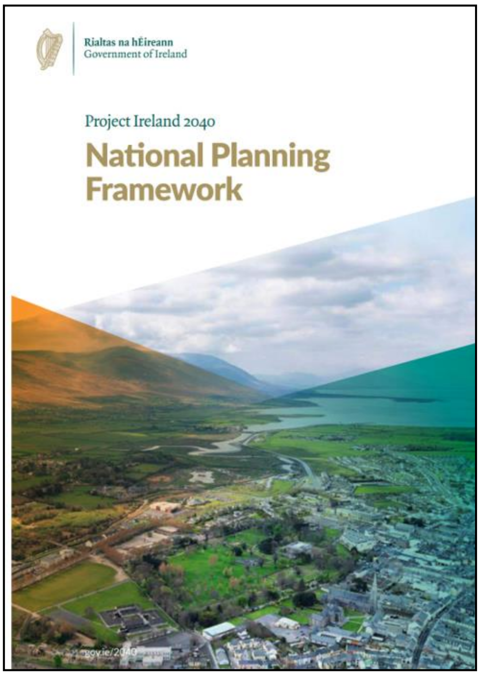

Plate 2.3 National Planning Framework, 2018

Waterford is the principal urban centre in Ireland's south-east and is unique in having a network of large and strong regional urban centres in close proximity that complement the role of Waterford. The NPF stresses that a stronger Waterford City would lead to economic recovery for the wider south-east which has experienced slower economic recovery than the national average in recent years, together with high unemployment rates, lower value job opportunities and less job creation. To enable future growth, the NPF has proposed the following key enablers:

- *"Delivering the North Quays SDZ regeneration project for integrated, sustainable development together with supporting infrastructure, including a **new pedestrian bridge or a pedestrian/ public transport bridge over the River Suir**; and*
- *Provision of Citywide public transport and strategic cycleway networks."*

As quoted above, the NPF directly calls for a new pedestrian/public transport bridge over the River Suir to support the North Quays SDZ. The bridge will also contribute to the objective to provide citywide strategic cycleway networks. The NPF also aims to achieve sustainable mobility through the following public transport objectives:

- Expand attractive public transport alternatives to car transport to reduce congestion and emissions and enable the transport sector to cater for the demands associated with longer term population and employment growth in a sustainable manner; and
- Develop a comprehensive network of safe cycling routes in metropolitan areas to address travel needs and to provide similar facilities in towns and villages where appropriate.

The NPF also highlights that recent census results show major increases in the proportions of people travelling by bicycle and walking where investment is made in enhanced active travel pedestrian and cycle facilities and where streets are made safer and more attractive. Proposals to develop green networks and infrastructure include the implementation of planning transport strategies for the five Irish cities, Dublin, Cork, Limerick, Galway and Waterford, and other urban areas with a major focus on improving walking and cycling routes including continuous urban greenway networks and targeted measures to enhance permeability and connectivity.

The NPF also sets out National Policy Objectives with the aim of achieving healthy communities. National Policy Objective 28 seeks to:

> "*Ensure the integration of safe and convenient alternatives to the car into the design of our communities, by integrating physical activity facilities for all ages, particularly prioritising walking and cycling accessibility to both existing and proposed future development, in all settlements*."

The proposed River Suir Sustainable Transport Bridge will provide walking and cycling facilities and an electric shuttle bus service for communities in the Ferrybank and Bellfield areas to access Waterford City centre. The proposal will also provide access to the North Quay SDZ from Waterford City centre. The proposed bridge will reduce the need for car dependence and will encourage residents to make healthy choices and live healthier lives through the provision of supporting infrastructure.

National Spatial Strategy 2002 - 2020

The National Spatial Strategy (NSS) 2002-2020 is a planning strategy designed to achieve a better balance of social, economic, physical development and population growth between regions. The strategy focuses on people, places and building communities. It recognises that through closer matching of where people live with where they work, Ireland will be able to sustain: -

- A better quality of life for people;
- A strong, competitive economic position; and
- An environment of the highest quality.

County Waterford is located in the South East Region of the NSS, which also covers Carlow, Kilkenny, Tipperary South and Wexford, as illustrated in Plate 2.4. Waterford

City is identified as the Gateway of the South East Region. The Gateway is supported by the towns of Kilkenny and Wexford as Hubs, and development in surrounding and adjacent towns. Plates 2.4 and 2.5 show the Gateway and Hubs identified for the South East region by the NSS.

The NSS states that balanced regional development needs to enhance the attractiveness of areas for people. It is proposed that physical and cultural liveliness will be required to ensure that there is a combination of attractive social and cultural facilities for both people and business at the Waterford Gateway. These facilities can be achieved through creating:

"...opportunities for consolidating Waterford City around the River Suir, with particular emphasis on the possibilities for developing the North Docks precinct"

The proposed development is supported by the NSS in terms of the connectivity between the north and south quays of Waterford City whilst aiding the development of the North Quays.

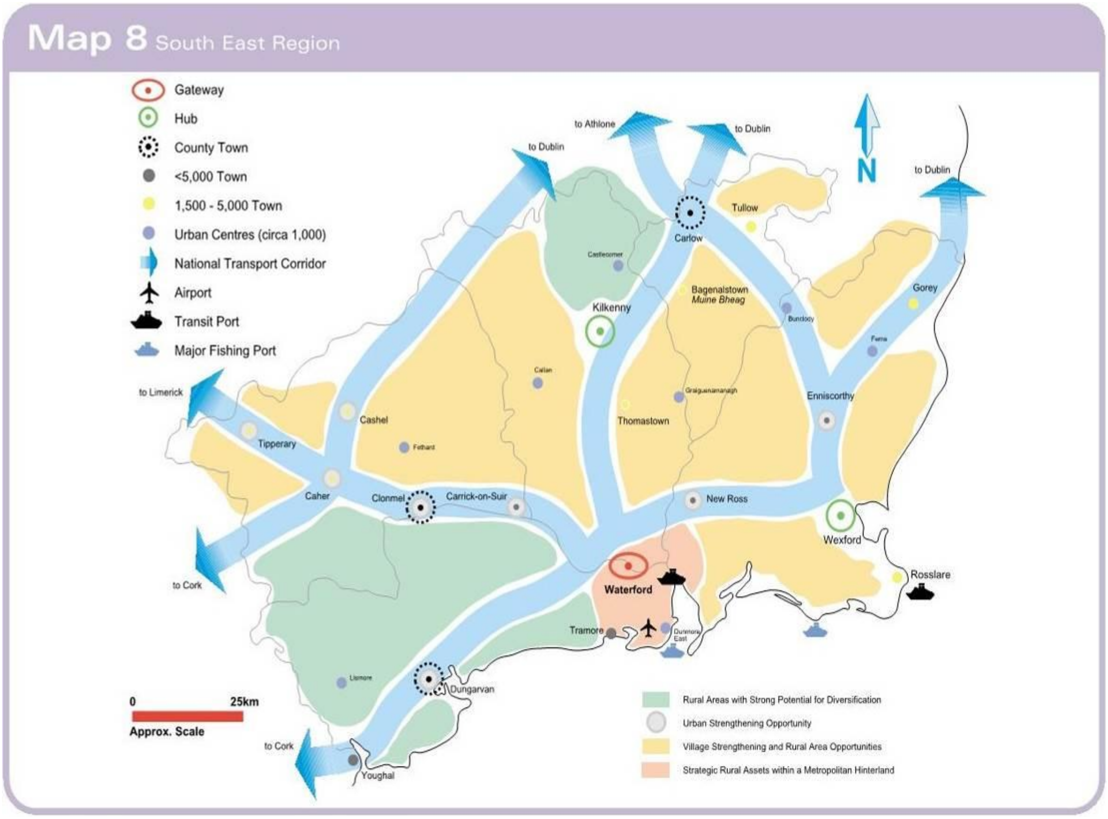

Plate 2.4 National Spatial Strategy South East Region

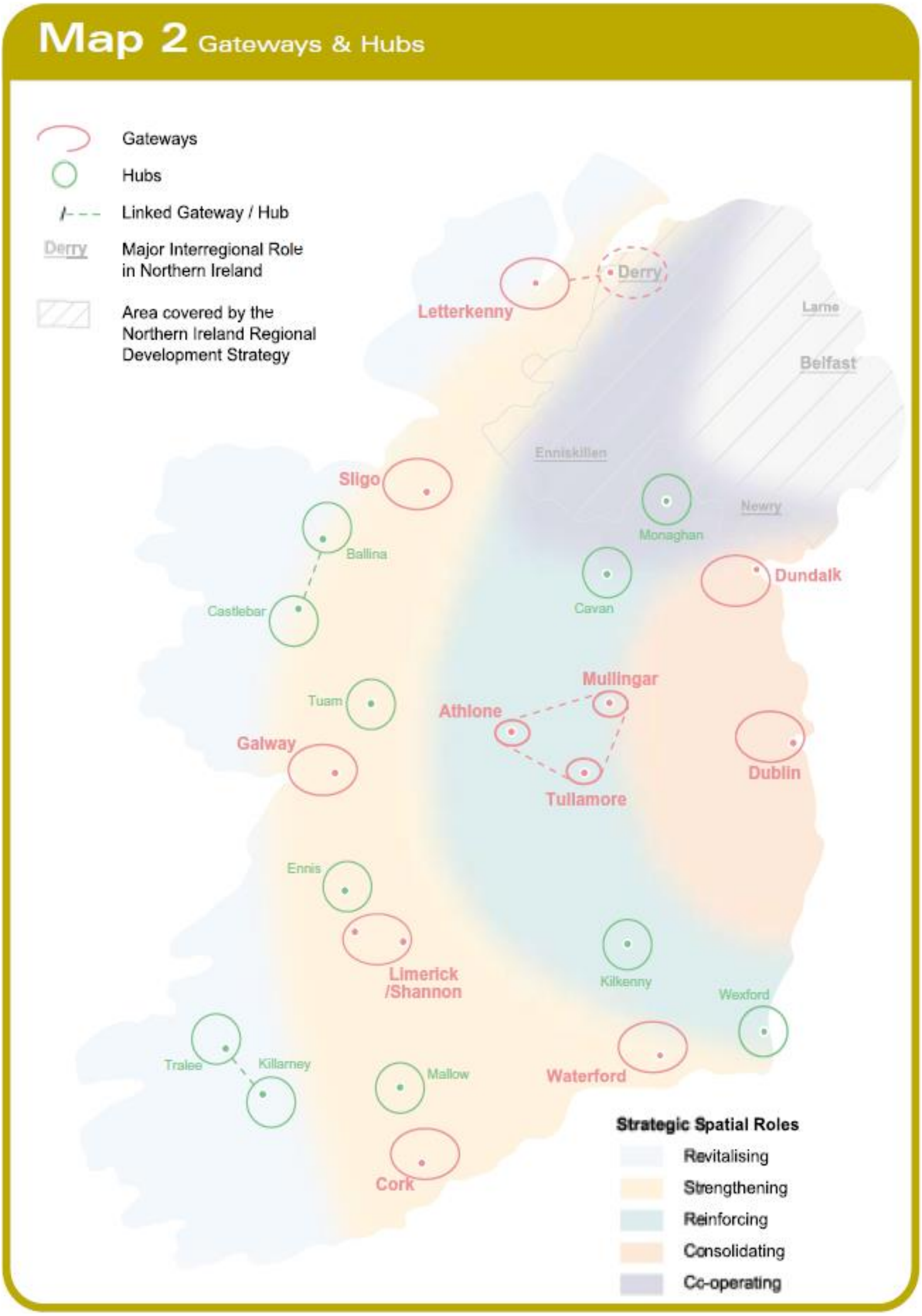

Plate 2.5 National Spatial Strategy Gateways & Hubs

Smarter Travel – A Sustainable Transport Future 2009 - 2020

Smarter Travel, A Sustainable Transport Future presents a transport policy framework for Ireland covering the period up to 2020. The policy, launched by the Department of Transport in 2009, sets out a vision, goals and targets to be achieved, and outlines 49 actions that form the basis of achieving a more sustainable transport future.

Despite the much needed investment promoted through Transport 21, congestion will intensify, transport emissions will increase, economic competitiveness will suffer and quality of life will decline unless sustainable transport policies are adopted.

The Smarter Travel policy document sets out five key goals as follows:

- Improve quality of life and accessibility to transport for all and, in particular, for people with reduced mobility and those who may experience isolation due to lack of transport;
- Improve economic competitiveness through maximising the efficiency of the transport system and alleviating congestion and infrastructural bottlenecks;
- Minimise the negative impacts of transport on the local and global environment through reducing localised air pollutants and greenhouse gas emissions;
- Reduce overall travel demand and commuting distances travelled by the private car; and
- Improve security of energy supply by reducing dependency on imported fossil fuels

The policy document sets out 49 Actions identified to achieve these key goals. The provision of the River Suir Sustainable Transport Bridge supports a number of the 49 actions contained within the Smarter Travel Policy, and is neutral with the remaining actions as detailed in Table 2.1 below.

Table 2.1 Smarter Travel Action Compliance Assessment

Action Number	Compliance	Comments
1	Supportive	Provision of a new pedestrian and cycle facility promotes walking and cycling to access community facilities and public transport.
2	Supportive	Provision of a new pedestrian and cycle facility, with direct access to Waterford City, supports the integration of land use planning.
3	Supportive	The provision of the proposed bridge is supportive of Action 3 and is supportive of the Waterford PLUTS 2004.
4	Supportive	The provision of a new pedestrian and cycle facility is supportive of Action 4 in promoting more sustainable travel patterns, such as cycling, walking and connecting proposed relocated train station.
5	Neutral	The proposal will not impact on e-working targets for the public sector.
6	Neutral	The proposal will not impact on establishment of e-working centres.
7	Supportive	The River Suir Sustainable Transport Bridge will provide a segregated safe route for pedestrians and cyclists from Waterford City to Ferrybank and from Ferrybank and Bellfield to Waterford City, thereby assisting in facilitating access to the schools. The resultant reduction in traffic volumes using Rice Bridge will also assist improving the road safety within the area for vulnerable road users and provide the platform for future enhancements to pedestrian and cycle amenities in Waterford City centre.
8	Supportive	The proposal will provide a dedicated safe route for vulnerable road users that allows for the connection of housing developments and the city centre, supporting a modal shift to non-motorised forms of transport for commuting to workplaces. It will not directly influence workplace travel plans.

Action Number	Compliance	Comments
9	Neutral	The River Suir Sustainable Transport Bridge will not impact on the promotion of personalised travel plans.
10	Neutral / Supportive	The River Suir Sustainable Transport Bridge will not impact on the promotion of freight policy. The resultant reduction in congestion on Rice Bridge, along Dock Road and along the South Quay will improve the efficiency of road based freight traffic through this area of Waterford City.
11	Neutral	The River Suir Sustainable Transport Bridge will not impact on the implementation of fiscal measures aimed at reducing car use.
12	Supportive	The provision of the River Suir Sustainable Transport Bridge will reduce the current congestion experienced along Dock Road, Rice Bridge and the South Quay and will thereby improve conditions for the operation of local road based public transport.
13	Supportive	This action is in relation to the provision of a bus service in urban areas. The River Suir Sustainable Transport Bridge will comprise a regular bus service and as such the implementation of the proposed bridge will have a supportive impact on this action.
14	Supportive	The River Suir Sustainable Transport Bridge will allow the connectivity of the Waterford Greenway and the proposed New Ross to Waterford Greenway and will therefore promote the implementation of sustainable transport modes for smaller urban areas.
15	Highly Supportive	The provision of the River Suir Sustainable Transport Bridge supports Action 15, through the provision of dedicated high quality safe shared pedestrian and cycling facilities linking Waterford City and surrounding housing estates. The proposed bridge will also link the Waterford Greenway with the proposed New Ross to Waterford Greenway. The reduction in vehicular traffic volumes along Dock Road, Rice Bridge and the South Quay will afford the opportunity to implement environmental improvement measures within Waterford City to improve the existing cycling infrastructure.
16	Highly Supportive	The provision of the River Suir Sustainable Transport Bridge supports Action 16, through the provision of dedicated high quality, safe, shared pedestrian and cycling facilities linking Waterford City and surrounding housing estates. The reduction in vehicular traffic volumes along Dock Road, Rice Bridge and the South Quay will afford the opportunity to implement environmental improvement measures within Waterford City to improve the existing cycling infrastructure.
17	Supportive	The implementation of the proposed bridge as a link to the Waterford Greenway and the New Ross to Waterford Greenway support Action 17 in providing greater access to these recreation facilities.
18	Neutral	The provision of the River Suir Sustainable Transport Bridge will not impact on the establishment of a car sharing website and initiatives.
19	Neutral	The provision of the River Suir Sustainable Transport Bridge will not impact on the establishment of car club schemes.

Action Number	Compliance	Comments
20	Neutral	Due to the potentially reduced traffic through this area of Waterford City centre as a result of the River Suir Sustainable Transport Bridge, the implementation of priority schemes for other forms of motorised transport including mopeds and segways can be investigated.
21	Neutral	The provision of the River Suir Sustainable Transport Bridge will not impact on the implementation of integrated ticketing systems on the public transport network.
22	Supportive	The River Suir Sustainable Transport Bridge will provide improved access to Waterford Train Station and Waterford Bus Station for pedestrians and cyclists, thereby providing greater connectivity for non-motorised users.
23	Supportive	The River Suir Sustainable Transport Bridge will include pedestrian phases to all traffic signal controlled junctions providing priority for pedestrians and cyclists. The proposal will provide improved access to public transport for non-motorised users.
24	Neutral	The provision of the River Suir Sustainable Transport Bridge will not impact on the implementation of an on-line integrated journey planner.
25	Highly Supportive	The implementation of the River Suir Sustainable Transport Bridge is supportive of Action 25 through the implementation of a new dedicated, segregated, safe walking and cycling route within Waterford City, linking the city centre with the North Quay SDZ and surrounding housing estates. The River Suir Sustainable Transport Bridge will also provide economic benefits to Waterford City, through alleviation of the continued reliance on the single crossing of the River Suir in Waterford City centre.
26	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the restructuring of the air navigation system in Europe and Ireland.
27	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the public service obligation for regional air transport services.
28	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the maritime transport sector emissions.
29	Supportive	The implementation of the River Suir Sustainable Transport Bridge will alleviate some of the traffic using Dock Road, Rice Bridge and the South Quays, thereby assisting the movement of goods by providing relief to the congestion currently experienced in this area.
30	Supportive	The provision of the River Suir Sustainable Transport Bridge will prioritise pedestrians, cyclists and public transport which will lead to a reduction in CO_2 emissions.
31	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact meeting the 10% target for Bio-fuels by 2020.
32	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact in meeting the 10% target for electric vehicle technology by 2020.

Action Number	Compliance	Comments
33	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the implementation of fuel efficient vehicle fleets in the public sector.
34	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the implementation of VRT and Motor Tax systems.
35	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact the Sustainable Energy Ireland (SEI) initiatives to introduce energy efficient technologies to the transport sector.
36	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on efficient driving module of the national driver test and implementation of on-board technologies to encourage eco-driving behaviour.
37	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact the introduction of a Sustainable Travel and Transport Bill. The River Suir Sustainable Transport Bridge will however support sustainable modes of transport through the provision of a new pedestrian and cycle facility.
38	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the interdepartmental working group.
39	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the establishment of the National Sustainable Travel Office.
40	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the establishment of the Dublin Transportation Authority.
41	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not support the Greater Dublin Area Transportation Strategy.
42	Supportive	The implementation of the River Suir Sustainable Transport Bridge supports the objectives of the Waterford PLUTS and the Waterford County Development Plan and will assist in modal shifts of behaviour through the provision of safe segregated pedestrian and cycle facilities connecting the city centre to surrounding housing developments.
43	Neutral	The implementation of the River Suir Sustainable Transport Bridge will not impact on the sustainable transport initiatives between Northern Ireland and the Republic of Ireland.
44	Supportive	The implementation of the River Suir Sustainable Transport will assist in delivering a modal shift of transport to more sustainable forms of transport through the provision of a dedicated, segregated, safe route for pedestrians and cyclists to access the city centre, the Waterford Greenway and Waterford bus station and Waterford train Station from the housing developments on the north and south of the river, affording the opportunity to further improve pedestrian, cycling and public transport facilities.
45	Neutral	The implementation of the River Suir Sustainable Transport will not impact on the training of local authority staff and result in the introduction of sustainable travel components to a course at third level institutions.

Action Number	Compliance	Comments
46	Neutral	The implementation of the River Suir Sustainable Transport will not impact on the introduction of branding to support the concept of smarter travel.
47	Neutral	The implementation of the River Suir Sustainable Transport will not impact on the introduction of fund to support innovative sustainable travel projects.
48	Neutral	The implementation of the River Suir Sustainable Transport will not have an impact on the introduction of a national travel, transport and mobility household survey.
49	Neutral	The implementation of the River Suir Sustainable Transport will not have an impact on the biennial reporting on the progress of the Smarter Travel Policy.

National Cycle Policy Framework, 2009 – 2020

The vision of the National Cycle Policy Framework is to create a strong cycling culture in Ireland, to the extent that by 2020, 10% of all trips will be by bike. It is hoped that encouraging cycling will provide an improved quality of life with benefits including better air quality, improved health including mental health, stronger communities and more sociable and vibrant streets. The modern approach to mobility is to provide more options, so transport options can be combined, using bicycles for some trips.

Proposed interventions are divided into hard and soft measures. Hard measures consist of engineering measures, planning and infrastructure such as permeable developments, cycling-friendly transportation infrastructural designs, removing cyclist-unfriendly systems, a focus on schools and integrating cycling and public transport. Soft measures are based on education and communication, using marketing tools to drive behavioural change in cyclists and road users. The fiscal benefits of cycling include the value to the health service due to increased activity, better productivity in the workforce and less congestion in urban areas. The National Cycle Policy Framework aims to provide appropriate levels of, and timely, funding towards its implementation.
The proposed development will support the hard measures of this plan, providing an opportunity for behavioural change. The location of the proposed development will ensure integration of cycling and public transport, providing a link between the proposed transportation hub as part of the North Quays SDZ and the bus station on the South Quay.

Building on Recovery - Infrastructure and Capital Investment 2016 – 2021

Building on Recovery is the Capital Plan that presents the Government's framework for infrastructure investment in Ireland over the period from 2016 to 2021.

It states that the "…*Capital Plan is a high level financial and budgetary framework. It is not part of the physical planning process*". It goes on to state that "*The Exchequer transport capital allocation is largely framed by the recommendations and priorities set out in the recently published Strategic Investment Framework for Land Transport. These priorities are threefold: to maintain and renew the strategically important elements of the existing land transport system; to address urban congestion; and to improve the efficiency and safety of existing transport networks*".

The Capital Plan combines direct investment by the Exchequer of €27 billion and investment from the wider semi-state sector, including Public-Private Partnerships

(PPPs) of €42 billion. The Exchequer and PPP component is primarily targeted at addressing priority needs in transport, education, housing and health care. The Plan also confirms the Exchequer Programme will provide support to proposals to develop and regenerate Waterford City's North Quays to support jobs and tourism in the region, when details are finalised. The River Suir Sustainable Transport Bridge, as proposed by the Waterford North Quays Planning Scheme, will play a large role in the regeneration of the North Quays, providing connectivity through from Ferrybank to Waterford City centre.

The Capital Plan has committed €100 million to smarter travel and carbon reduction measures, including greenways, to ensure that the transport sector makes a major contribution to climate change mitigation targets. Encouraging public transport alternatives to private vehicular options is a key element in reducing Ireland's carbon emissions, by providing a viable, less polluting alternative to car and road transport. By creating a new pedestrian/cycle/public transport link between the North and South Quays, a high quality, safe alternative to the private car will be provided for commuters between Waterford City centre and surrounding areas such as Ferrybank, Bellfield and the proposed North Quays SDZ. Due to the proposed relocation of the Waterford train station to Dock Road as part of the SDZ proposal, the proposed development will impact on a wider range of commuters, creating an essential link between the proposed transport hub and Waterford City centre.

Investing in Our Transport Future – A Strategic Framework for Investment in Land Transport

The Strategic Framework for Investment in Land Transport (SFILT) which was published by the Department of Transport, Tourism and Sport (DTTAS) outlines the key principles against which national and regional, comprehensive and single mode based plans and programmes will be drawn up and assessed. The framework does not set out a list of projects to be prioritised, however the following three priorities are noted in terms of investment:

- Priority 1 – Achieve steady state maintenance;
- Priority 2 – Address urban congestion; and
- Priority 3 – Maximise the value of the road network.

In terms of Priority 2, the report states that "*measures should include: Improved and expanded walking and cycling infrastructure. Investment in improving the quality and time competitiveness of alternatives to the car often play an important role as a driver of modal shift and should be supported*." The implementation of these projects in conjunction with supportive spatial planning policies is also encouraged, in securing investment.

In terms of Priority 3, the report states that "the value of the road network will be maximised through targeted investments that:

- in the case of roads, provide access to poorly served regions, for large-scale employment proposals, to complete missing links and to address critical safety issues; and
- support identified national and regional spatial planning priorities.

The proposed River Suir Sustainable Transport Bridge will support the objectives of the SFLIT by providing a sustainable transport alternative to the private car and improving connectivity to and within the Ferrybank, Bellfield, North Quays SDZ and Waterford City.

Project Ireland 2040, National Development Plan 2018 – 2027

The Government published Ireland's National Development Plan 2018 – 2027 (NDP) to drive long term economic, environmental and social progress in Ireland over the next decade. The National Development Plan is integrated with the NPF.

In relation to Waterford, the NDP recognises the Waterford North Quays SDZ regeneration project as a potential project for receiving funding from the Department of Housing, Planning and Local Government. The proposed development will play a crucial part in facilitating this redevelopment and is included in the objectives of the North Quays Planning Scheme. The NDP also recognises that a number of sustainable transport projects will be delivered in Waterford to provide sustainable travel options including urban cycling and walking routes.

The location of the proposed bridge will encourage the switch from private car and will encourage sustainable modes of transport, thereby alleviating congestion and helping to meet climate action objectives.

2.2.4 Regional Policy Context

Regional Planning Guidelines for the South East Region 2010-2022

The South-East Region covers Waterford City and Carlow, Kilkenny, South Tipperary, Waterford and Wexford. Covering approximately 13.5% of the state, the region was home to about 11% of the population (460,838) in 2006 at the time of publishing. The Regional Planning Guidelines provide a strategic planning framework for the South-East Region with the objective of implementing the NSS at regional level and achieving balanced regional development.

With regards to transportation, the long-term objective of the South-East Regional Authority is to '*achieve balanced regional development through the development of an integrated sustainable transport system involving road, rail, air, sea, bus, cycling and walking'*. The Regional Authority supports the development of dedicated walkways and cycleways such as 'Slí na Sláinte' and 'Greenways' in urban and rural areas, e.g. along the trackbeds of former railway lines. Emphasis will be given to provision of safer cycling and pedestrian routes to schools and a safer environment in the immediate vicinity of schools, where opportunities arise.

The regional planning guidelines have been adopted by the authority for the south-eastern region and they are based on implementing the policies in the Government Policy '*Smarter Travel: A Sustainable Transport Future*'.

The Regional Planning Guidelines for the South-East Region 2010-2022 contain the following policies for sustainable infrastructure;

PPO 5.8 It is an objective of the Regional Authority:

- *To support walking and cycling as the mode of first choice for journeys up to 7 kilometres;*
- *To promote and facilitate the sustainable development of cycling and walking facilities in the region, including development of 'Slí na Sláinte' and 'Greenways' in urban and rural areas;*
- *To promote the development of cycling by the construction and improvement of cycle links within the region. Where cycle links are proposed adjacent to designated Natura 2000 sites, Appropriate Assessment Screening will be required in accordance with Article 6 of the Habitats Directive;*

- *To encourage the provision of secure bicycle parking facilities in towns, at neighbourhood centres, at public facilities such as schools and libraries and in all new developments;*
- *To support the sustainable development of the inter-urban National Cycle Network so that the majority of the network is off-road;*
- *To promote the objectives of the Department of Transport's National Cycle Policy Framework in the development of cycling facilities;*
- *To comply with the 'European Charter of Pedestrian Rights' in order to improve facilities for pedestrians and access to such facilities for people with disabilities. PPO 5.9 The Regional Authority will support measures to prioritise improved pedestrian use and traffic calming and cycling facilities as part of an integrated approach to the sustainable management of movement.*

The proposed development will provide and facilitate the sustainable development of segregated cycling and walking facilities in a manner consistent with this regional policy.

The Southern and Eastern Regional Operational Programme 2014 - 2020

The Southern and Eastern Regional Operational Programme 2014-2020 was prepared in co-operation with a wide range of partners and stakeholders as required under Article 5 of the Common Provisions Regulation and as detailed in the 'Code of Conduct on Partnership' which is intended to support and facilitate Member States and Managing Authorities in the implementation of the partnership principle.

Priority 5. Sustainable Integrated Urban Development had an allocation of €52 million with the priority objectives to: 1) support low carbon sustainable, multimodal urban mobility in designated urban centres and 2) to revitalise, regenerate and improve the urban environment in the designated urban centres as part of integrated urban strategies. The Designated Urban Centres Grant Scheme under Priority 5 has an objective to increase the number of integrated urban regeneration initiatives to improve the urban environment and revitalise urban areas. The Waterford Gateway project is funded by the Grant Scheme which is financed under the European Regional Development Fund co-funded Southern and Eastern Regional Programme. The Waterford City project will entail carrying out high quality accessible public realm improvements and balance transport modes. It will improve access and encourage the proposed new retail shopping initiative at the southern end of the retail spine to improve the city's retail offer. Together with regeneration of substantial brownfield sites in the city centre, an urban mobility plan will give priority to sustainable modes of transport. The proposed development supports the Programme as it will improve accessibility, promotes sustainable mobility and will regenerate the surrounding area.

The South East Economic Development Strategy (SEEDS) 2013 – 2023

This strategy is an Action Plan for the south east arising from the Joint Committee on Jobs Enterprise and Innovation, in response to the unemployment crisis in the region. The objective of the strategy is to identify the economic needs of the southeast, prioritising the urban centres, recognising disparities, addressing geographical inequalities and driving balanced regional development.

The aim is to focus on the Southeast's key strengths in tourism, developing a critical mass of expertise through improved educational attainment, delivery of a Technological University and strong research and development. The strategy aims to maximise the potential of existing key assets such as the two ports of national significance (Rosslare and Waterford), the regional airport and develop a regional transport hub that aligns road, rail and port infrastructure.

The proposed development will enhance economic development within the Southeast region, providing connectivity and access between Waterford City centre and the proposed transport hub that is proposed as part of the North Quays SDZ. This will aid the development of the North Quays as a Key Strategic Site, which will provide employment through mixed use developments.

2.2.5 Local Policy Context

Waterford North Quays Strategic Development Zone Planning Scheme 2018

The Planning Scheme for the Waterford North Quays SDZ was prepared by Waterford City and County Council for the site which was designated by the Government as a SDZ in January 2016. The Planning Scheme outlines a vision and principal goals for the development and includes Specific Objectives under the headings of; Physical and Social Infrastructure, Planning Strategy, Architectural Strategy and Actions and Implementation.

An access strategy is included within the Planning Scheme, ensuring the future demands for travel are met in a sustainable way (see Plate 2.6). The strategy of the scheme is to limit car usage by making alternative modes of transport more accessible and attractive. A sustainable transport bridge capable in width to accommodate pedestrians, cyclists and a public bus is proposed from the North Quay to the South Quay in the vicinity of the Clock Tower on the South Quay. The bridge is proposed to provide direct access to the city centre for pedestrians and cyclists, a vital link in the connection of the Waterford Greenway to the proposed New Ross to Waterford Greenway and an opportunity for the retail sector in the city to operate a courtesy bus which would connect the North and South Quays. The bridge is regarded as a critical piece of enabling infrastructure and is required to have an opening centre section to allow the continuing use of the river by marine traffic.

The proposed development fully satisfies the requirements of the Planning Scheme and will promote a modal shift away from the private car. The proposed bridge will support the following Specific Objectives:

PSI 1: To develop and promote a modal shift away from the private car use towards increased use of a sustainable integrated multi modal transportation network to include walking, cycling public transport integrating bus and rail infrastructure. All future planning applications shall demonstrate how they seek to implement the actions contained in the Government's "Smarter Travel, A Sustainable Transport Future 2009-2020".

PSI 2: To support and facilitate the development of an integrated public transport network with efficient interchange between transport modes, to serve the existing and future needs of all ages in association with relevant transport providers, agencies and stakeholders and to facilitate the integration of walking and cycling with public transport.

PSI 4: To provide a cycle and sustainable transport bridge across the river to form part of strategic cycling and walking routes.

PSI 5: To create and support a well-designed network of pedestrian infrastructure to promote and facilitate walking and cycling; provide priority for pedestrians and cyclists within the North Quays and linking with the surrounding walking and cycling networks in Waterford/Kilkenny environs, including the Waterford/New Ross Greenway.

Plate 2.6 Access Strategy of the Waterford North Quays Planning Scheme

Waterford City Development Plan 2013 – 2019

Chapter 5 of the Waterford City Development Plan – City Centre, outlines a number of objectives focused on protecting the role of the city centre and supporting its expansion as an economic force and capital of the region. The plan outlines the opportunity for the dynamic transformation of the area and waterfront and the need for redevelopment of the North and South Quays which would in turn, revitalise the river landscape by sustainably integrating everyday city life with the river.

The Plan outlines a number of objectives regarding a pedestrian crossing of the River Suir. The following objectives are contained within the plan:

- To provide an appropriately designed and constructed pedestrian river crossing located in the vicinity of the Clock Tower to provide accessibility to the North Quays and facilitate future development. (OBJ 6.2.7)
- Investigate the feasibility of provision of an open span bridge facilitating a light public transport system in the vicinity of Reginald's Tower linking up with future development on the north quays. The provision of such a looped transport system in the City is desirable. There is an option for such a looped transport system also being facilitated via a new pedestrian bridge at the Clock Tower as per the North Quays Urban Design Framework. (OBJ 6.2.8)
- To expand the network to connect the city centre to any proposed North Quay development with a foot/cycle bridge. (OBJ 6.2.2)

Other objectives which the proposed development would support include:

- To facilitate the development of an accessible city centre, with particular reference to persons with disabilities, pedestrians and cyclists and to improve the availability of public transport, and short-term parking, within easy reach of the central area. (POL 5.4.6)
- To provide a citywide cycle network to link all areas of the city to each other via main routes. Existing and proposed extension of the city's cycle network is also outlined on the zoning objectives map. The proposed network is both radial and orbital, with some elements located off street in amenity areas. (OBJ 6.2.1)
- To provide cycle and walking networks between neighbourhood areas, further negating the need for car based journeys. (OBJ 6.2.4)

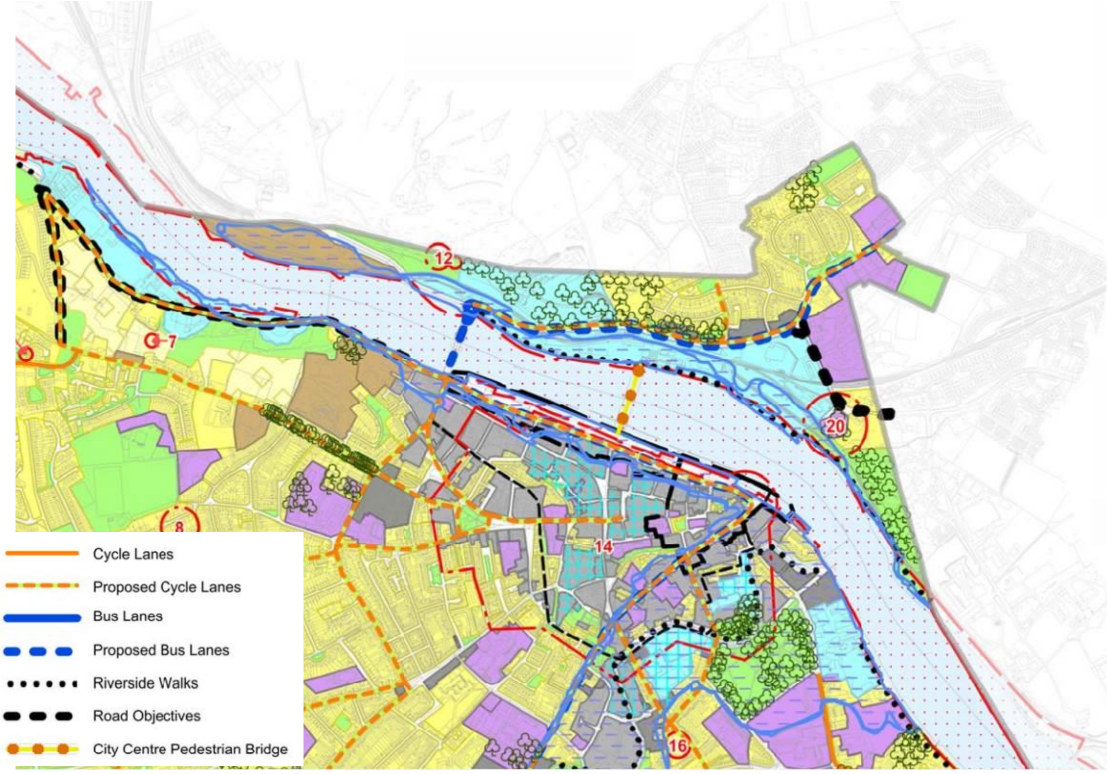

Plate 2.7 Proposed location of the City Centre Pedestrian Bridge (Waterford City Development Plan 2013-2019)

Waterford County Development Plan 2011 – 2017

The Waterford County Development Plan is largely in favour of promoting walking and cycling connections throughout the urban and rural areas of Waterford. The following policies and objectives are included in the plan and are supportive of the proposed development:

- Policy ECD 22 It is the policy of the Council to continue to promote and facilitate, where possible, the provision of high quality walking and cycling routes in Waterford.
- Policy ECD 23 It is the policy of the Council to promote Waterford as the "Walking Capital of Ireland."
- Policy INF 14 To implement the smarter travel policy framework as produced by the Department of Transport and to encourage the sustainable creation of cycle and pedestrian friendly communities through the provision of cycle paths and other initiatives to curtail the dependency on private motor vehicles whilst seeking to minimise the depletion of the hedgerow resource that could potentially arise from cycle path provision.
- Objective INF 5 It is the objective of the Council to support the policies of the 'National Cycle Policy Framework 2009-2020-Smarter Travel', Department of Transport, April 2009 while ensuring that any environmental effects of the implementation of the policies are fully assessed and adequately mitigated.
- Objective INF 6 It is the objective of the Council to promote the sustainable development of safe and convenient pedestrian and cycling facilities in the towns and villages, to minimise the dependence on private motor vehicles, and to encourage an active and healthy lifestyle. New and upgraded road developments will be encouraged to integrate cycle lanes. These will include urban/village developments and short distance routes.

- Objective INF 7 Require planning applications for residential, commercial, retail, community, educational and industrial developments to demonstrate the proposal's accessibility for pedestrians and cyclists. The Council will also seek the provision of appropriate, well-designed pedestrian ways for residential development proposals to link with amenities and facilities. Such proposals shall adhere to the Guidelines on Sustainable Residential Development in Urban Areas and Urban Design Manual (DoEHLG May2009).
- Policy INF 15 The Council encourages a high quality of design and layout proposals within urban areas, which strive for universal accessibility for pedestrians, to provide adequate and convenient access to public transport and reduce the dependence on the private motor car.

Waterford Planning, Land Use and Transportation Study (PLUTS) 2004

The Waterford PLUTS 2004 was adopted by Waterford and Kilkenny Councils in 2004 in order to provide a vision and strategy for the development of Waterford City and Environs up to the year 2020. A key element of the Study is the achievement of critical mass to allow the city to reinforce and develop its role as the economic driver of the South-East region of Ireland. The key issues outlined are achieving critical mass, developing a compact, balanced city, integrating land use and transport, harnessing the excellence of the educational resource, utilising existing key assets and managing growth.

A key development challenge for Waterford and its environs according to the PLUTS is to fully harness its riverfront potential and the amenity of the river in the city as a central focus for the development of a new Irish urban experience. The North Quays are identified as a primary redevelopment area, with a proposed new city centre bridge for pedestrians and cyclists and the provision of a new rail platform on the North Quays as part of a public transport interchange. The Study includes the proposed bridge as a relevant transportation feature:

> *"A new city centre bridge for pedestrians and cyclists which will link the redeveloped North Quays with the existing City Centre"*

An efficient and sustainable transport system has a key role to play in easing and improving accessibility and mobility within a compact urban area, while in the short-term, growth is recommended to be provided through more river linkages including the supply of a choice of transport modes that promote public transport including bus, rail, cycling and walking. The Study aims to maximise segregated facilities for pedestrians and cyclists and the proposed River Suir Sustainable Transport Bridge will provide a key pedestrian and cycle link between the north and south quays. The PLUTS highlights that any master plan for the North Quays must investigate the feasibility of providing the bridge in conjunction with the development.

The proposed development will satisfy the proposals outlined in the PLUTS by providing a bridge for pedestrians and cyclists, easing and improving accessibility between the city centre and the future redevelopment of the North Quays through an additional river crossing.

Waterford North Quays Urban Design Framework Plan (2008)

The Urban Design Framework was designed by Waterford City Council to develop a broad vision, basic development concepts, integrated framework plan, key urban design guidelines and measures for implementation for the North Quays area of the City.

A new City Centre bridge exclusively for pedestrians and cyclists linking the redeveloped North Quays with the existing City Centre is a principal feature of the Plan. The potential for the bridge to facilitate a light city centre public transport loop is also to be investigated. The bridge is said to enable the expansion of the main street and space structure of the city centre by providing new connections to the north quays, Ferrybank and the larger environs. It will also provide a vital link between the pedestrian and cycle networks of the north and south sides of the river, and improving movement and access to the existing bus station. The development guidelines within the plan state that the proposed pedestrian bridge will be a key enabler of development, not only 'opening up' the area for development and associated footfall, but potentially serving as an icon for the area and the city. The design will be a crucial factor in overcoming access constraints arising from level differences.

The proposed development is a key enabler of the Waterford North Quays Urban Design Framework Plan and the proposed expansion of the City Centre.

Ferrybank – Belview Local Area Plan, 2017

The Ferrybank – Belview Local Area Plan (LAP) 2017 came into effect in January 2018. This LAP includes various transport objectives and outlines a strategy for the proper planning and sustainable development of the Ferrybank and Belview areas.

The LAP re-emphasises the PLUTS requirement for a "*new city centre bridge for pedestrians and cyclists which will link the redeveloped North Quays with the existing City Centre*". The Plan also highlights that the Ferrybank/Belview area is in close proximity to Waterford City which "*means that many opportunities exist for the promotion of walking, cycling and public transport".*

Kilkenny County Development Plan 2014-2020

The Development Plan sets out Kilkenny County Council's policies and objectives for the proper planning and sustainable development of the county from 2014 to 2020. The Development Plan aims to implement the provisions of the Regional Planning Guidelines and to target the growth of the Ferrybank/Belview area within the Waterford environs to advance sustainable development. The proposed development will assist with allowing the sustainable development objectives of the Plan to be realised by encouraging sustainable modes of transport. The proposed development will also allow South Kilkenny to grow by connecting the region with Waterford City centre.

Waterford City Centre Urban Renewal Scheme, 2015

The Urban Renewal Scheme outlines public realm upgrades, alterations to traffic circulation and urban realm improvements. Its Vision includes maximising the potential of the City Centre to continue to grow as a national and regional destination. The proposed development would complement and facilitate the urban renewal of this area and Waterford City through alleviating traffic along Rice Bridge, offering an alternative mode of transport to and from Waterford City and ensuring greater connectivity in the city.

Economic Strategy for Waterford City and County, 2013

The Economic Strategy identifies measures which include a series of interventions that will help to reposition Waterford as a top class micro city at European level and as the key driver of the South East Region. These interventions are designed to improve the economic performance of both Waterford and the South East Region to build a robust pathway of economic growth for Waterford and the South East. The Strategy recognises Waterford's strengths and weaknesses and develops a strategy accordingly. The proposed River Suir Sustainable Transport Bridge will assist the economic strategy reach its objectives by improving connectivity of Waterford City with residential areas in South Kilkenny and with the proposed North Quays Strategic Development Zone.

One Waterford: Local Economic & Community Plan, 2015-2020

The Plan identifies and delivers positive step changes that will deliver the economic and social transformation of Waterford, to grow the local and regional economy, strengthen Waterford's role as the regional leader of the South East, ensure that our communities are strong and engaged, and ensure that all people have an excellent quality of life. An objective of the plan is to revitalise, regenerate and improve the urban environment, including realising the economic potential of the North Quays by 2019. The proposed River Suir Sustainable Transport Bridge is necessary in order for these objectives to be realised.

Chapter 3
Alternatives Considered

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Chapter 3 Alternatives Considered

3.1 Introduction

Directive 2011/92/EU (as amended by Directive 2014/52/EU), Article 5(d) provides that the information to be provided by the developer shall include "*a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment*".

This chapter outlines the alternative options considered for crossing the River Suir. Roughan & O'Donovan carried out a multi-criteria analysis (MCA) for 5 no. bridge options, taking into consideration many aspects including environmental impact. The bridge options were also assessed for their durability and future maintenance needs, buildability, construction and whole life costs and disruption/impact during construction as outlined in this chapter. Alternative bridge locations have not been assessed in this EIAR as this proposed bridge location is identified in the Waterford County Development Plan 2013-2019, the Planning Scheme for the North Quays Strategic Development Zone (SDZ) and the Waterford Planning, Landuse and Transport Strategy (PLUTS) 2004.

3.2 Project Brief Requirements

The proposed sustainable transport bridge is required to stimulate the coherent development of the city's various quarters, in particular integrating the substantial housing areas in Ferrybank and the proposed North Quays redevelopment with the city centre on the South Quays. The bridge is to be located in line with Barronstrand Street/ the Clock Tower to provide a continuous link connecting the city centre retail spine to the North Quay and beyond.

Five bridge options were developed in accordance with the following requirements:

- The bridge shall act as a public amenity affording greater appreciation and enjoyment of the river;
- The bridge elevation is to have a modest profile;
- The bridge solution shall be simple, elegant and sympathetic to its historic location and topographical setting as well as enhancing the long views from the length of both quays;
- High quality detailing;
- Safety – both real and perceived;
- Pedestrian and cycling use, access for all;
- A span of approximately 215m and a width of 3.5m to 4m;
- A design that reduces the perceived length of the bridge;
- Predicted flood levels and its effects on the bridge landing areas on the North and South Quays;
- Fully integrated design with the existing parking at the South Quays plaza and 19th century Clock Tower which is an important civic structure;
- Fully integrated design with the future North Quay development plaza at the bridge north side landing area;

- The relocated railway station entrance being in close proximity to the bridge landing area on the North Quays;
- Fully integrated design for disabled access;
- Integrated public lighting;
- The provision of a 25m clear span bridge opening section to permit river traffic with appropriate control location and structure for its operation;
- Public lighting providing safety and security in combination with sensitive architectural lighting which works with the sensitive marine landscape in which the bridge is sited;
- Appropriate pedestrian wind protection that provides a sense of safety and ensures the usability of the bridge in typical weather conditions; and
- Traffic access protection bollards at both bridge ends.

3.3 Design Parameters and Constraints

The Environmental Constraints Report for the Waterford North Quays Redevelopment project comprised a data collection exercise which focussed on determining the physical, environmental and engineering constraints which exist and which could affect the design and progress of the proposed development within the proposed study area

The Constraints Study was carried out at an early stage of the project with the objective of gathering as much background information relating to the study area as possible. The main design parameters and constraints arising from the constraints study in 2016 are listed below:

(i) Planning and Landuse

Policies were reviewed and objectives that support the development of a pedestrian bridge over the River Suir, green routes and cycling infrastructure were identified within the study area. These transport objectives were considered as part of design options for this project.

(ii) Biodiversity

The principal ecological constraint identified was the requirement to protect and enhance the conservation objectives of the Lower River Suir Special Area of Conservation (SAC) (site code 002137). The Lower River Suir SAC supports a range of Annex II species and Annex I habitats. Habitat and species surveys were required to confirm the presence of habitats and species on site. Hydrodynamic modelling was required, and a Natura Impact Statement was determined necessary for the proposed development. Consultations with NPWS and IFI were required as part of this process.

(iii) Hydrology

The protection of river water quality of the Lower River Suir SAC was an important consideration of the project design. Compliance with the requirements of the Water Framework Directive and the protection of fish populations were key considerations of the design process. Flood risks due to the construction and operation of the proposed development were important considerations. Hydrodynamic modelling was carried out for the project. A Flood Risk Assessment was carried out for the North Quays SDZ and incorporated the proposed sustainable transport bridge.

(iv) Soils and Geology

Geotechnical investigations have been carried out to inform potential contaminated land issues and ground conditions / depth to rock. The Port of

Waterford was consulted during the options assessment to establish if any maintenance/ dredging requirements should be considered which may impact on design options or construction operations.

(v) Archaeological and Architectural Heritage

The free standing crane on the South Quay is identified as a building/structure of Architectural Heritage and is included as part of the NIAH. The free standing crane is a protected structure.

The South Quays contain numerous protected structures and is designated as an Architectural Conservation Area (ACA). The study area is included as part of a Zone of Archaeological Potential which extends into parts of the Lower River Suir SAC. Consultation with the National Monuments Service (NMS) and an underwater archaeology assessment are necessary.

(vi) Landscape and Visual

There are a number of protected views to and from the study area included in the Waterford City Development Plan 2013-2019 and Ferrybank- Bellview Local Area Plan 2009.

The choice of the bridge width for pedestrians, cyclists and the electric vehicle is a key consideration in the design, both in terms of mobility and economics. While a bridge functional deck width of 3.5m to 4m was a requirement of the Project Brief as detailed in Section 3.2, this functional width was increased to 6.0m in order to meet relevant cross-section dimensional standards and accordingly meet the strategic objectives of the project. For the proposed bridge, taking into account the strategic location of the bridge in the city centre, it is recommended that a proposed functional width of the footpath shall be a minimum of 3m. This requirement was derived from the Transport Infrastructure Ireland (TII) Publication DN-STR-03005 Design Criteria for Footbridges. In addition, the proposed width of the cycleway has been based on the document, Provision of Cycle Facilities – National Cycling Manual published by the National Transport Authority (NTA) in 2011. Cycle lane widths shall be a minimum of 1.25m according to this design manual. Therefore, adopting a minimum two-lane cycleway with each lane of width 1.25m results in a proposed cycleway cross-section of 2.5m. The total functional width of the bridge is therefore proposed to be 6.0m comprising a footway with a width of 3.0m, a cycleway width of 2.5m, and a buffer zone of 0.5m.

3.4 Bridge Options Considered

The following five options have been assessed for the proposed bridge:

- Bridge Option 1 – Functional Opening Bridge
- Bridge Option 2 – Aesthetic Opening Bridge
- Bridge Option 3 – Functional Fixed Bridge
- Bridge Option 4 – Aesthetic Fixed Bridge
- Bridge Option 5 – Alternative Aesthetic Fixed Bridge

Bridge Option 1 – Functional Opening Bridge

The proposed bridge is 217m in length with a constant deck footway/cycleway width of 6m over its length. The deck alignment is straight on plan and follows a constant gradient of 1.2% (1 in 83 slope) rising from the South Quay landing area (+3.5m above Ordnance Datum Malin Head (mOD)) to the proposed North Quay plaza (+6.05mOD). 1.4m high metal parapets are provided along both edges to suit cycle requirements and will be fitted with wind shielding where required.

The bridge deck layout consists of 7 spans; a 38m long central span (opening) and four interior and two end fixed spans of 33m and 26m length respectively. The opening span is a single leaf bascule (fixed trunnion type) with approximately 30m of its length lifted about the pivot and the remaining length accommodating the lifting device/ machinery and counterweight. This arrangement provides the required 25m wide navigation clearance.

The visible depth and profile of the bridge deck parapet support and beams in elevation has been kept constant across all spans (approximately 1.7m) in order to provide uniform structural appearance of modest profile. The fixed spans are of standard beam and slab construction comprising 3 no. precast prestressed concrete U shaped beams, with an in situ concrete deck slab. The 1.4m deep beams, together with the in situ slab of approximately 250mm average thickness, provide a total structural depth of 1.65m and a total deck width of 7m (6m deck width between parapet rails). The opening bascule span is also of standard construction comprising a single steel box girder with the box top flange (orthotropic steel deck) providing the walkway/cycleway surface for the deck above. The steel deck for this span is required in order to minimise the weight for the bascule lifting apparatus.

The bridge substructure will be of in situ concrete construction. The typical piers and abutment supports will have a slender simple wall form (pattern printed) of constant width (approximately 1.0m) and length of approximately 2.9m. The bascule pier is required to accommodate the opening span lifting devices and equipment, together with the counterweight resulting in substantially increased pier width (approximately 10m) and height dimensions. The bridge deck is detailed as integral (without mechanical bearings) as far as practicable across its length in order to minimise future maintenance needs. Mechanical bearings will be required however at both Quay abutment supports and the northern connection to the bascule pier.

The bridge substructure will be supported on 750mm diameter steel cased bored concrete piles; the number of piles varying to suit the loading requirements. Based on the available ground investigation data at the constraints stage, piles will have an average length of 17 to 18m assuming a bedrock level of 17.7mOD. The proposed bridge layout and cross section of Bridge Option 1 are presented in Figures 3.1 and 3.2 of Volume 3 of this EIAR.

Bridge Option 2 – Aesthetic Opening Bridge

The proposal for this option is an architecturally designed bridge with structural and aesthetic features designed to enhance the user experience of the crossing as well as enhancing the long views from the length of both quays. The perceived length of the 6m wide x 217m long crossing has been reduced with the introduction of feature arches/viewing points at approximately the bridge third points in conjunction with a varying footway vertical profile which forms a smooth curve in elevation. The high point of the footway vertical curve (6.65mOD) is located at the northern arch feature, 70m from the North Quay landing (+6.05mOD). The bridge slopes from this point to tie in to the South Quay landing area level (+3.5mOD) at an average gradient of 2.2% (1 in 45 slope).

The bridge has an overall visible depth (including parapets) in elevation of approximately 1.9m. The parapets form part of load carrying structure resulting in this slender profile of the bridge deck which is constant over the bridge extents with the exception of the portions over the two central pier support locations where the feature arches have been introduced. The arches are located on one side of the deck only at each central pier resulting in an asymmetric bridge in both elevation and cross section at these locations. At the northern bridge end the arch develops on the west side, and at the southern end on the east side of the bridge. These architectural feature arches are provided with a pedestrian parapet with glass panel infill serving to provide unobstructed viewing points of the river and the glass panel providing wind shielding during adverse weather conditions.

The 7 span bridge deck has been laid out symmetrically and comprises a 70m long central span (14m wide opening section), interior spans of 35m and 25m, and end spans of 12.245m length. The opening section of the central span is detailed as a hydraulically operated twin leaf bascule bridge with all hydraulics located within the depth of the bridge deck. A proposed navigational clearance of 25m has been agreed with the Waterford Port Authority and Waterford City and County Council (WCCC) following consultations.

The steel bridge deck has a half through configuration (U shaped) consisting of a varying depth closed box girder over the 6m wide footway (600-800mm deep) connecting two main box shaped girders (1.9m deep) protruding above the deck on either edge. The two edge girders also form the bridge parapet and provide inherent wind protection to users due to their solid nature.

The bridge substructure will be of in situ concrete construction. The main span piers support the deck by means of inclined struts which are integrally connected to the steel deck and converge to a concrete squat pier at their base. The typical piers and abutment supports will have a slender simple wall form (pattern printed) of constant width (approximately 1.2m) and length of approximately 2.9m. The bridge deck is detailed as integral (without mechanical bearings) as far as practicable across its length in order to minimise future maintenance needs. Mechanical bearings will be required however at both Quay abutment supports.

The bridge piers will be supported on large pile caps located below the low water mark. 750mm diameter vertical and inclined steel cased bored concrete piles are proposed with the number of piles varying at each substructure to suit the loading requirements. Based on the available ground investigation data at the constraints stage, piles will have an average length of 17 to 18m assuming a bedrock level of 17.7mOD. The proposed bridge layout and cross section of Bridge Option 2 are presented in Figures 3.3 and 3.4 of Volume 3 of this EIAR.

Bridge Option 3 – Functional Fixed Bridge

The proposed bridge is 217m in length with a constant deck footway/cycleway width of 6m over its length. The deck alignment is straight on plan and follows a constant gradient of 1.2% (1 in 83 slope) rising from the South Quay landing area (+3.5mOD) to the proposed North Quay plaza (+6.05mOD). 1.4m high metal parapets are provided along both edges to suit cycle requirements and will be fitted with wind shielding where required.

The bridge deck layout consists of 7 spans; five interior spans of 33m and two end spans of 26m. The visible depth and profile of the bridge deck parapet support and beams in elevation has been kept constant across all spans (approximately 1.7m) in order to provide uniform structural appearance of modest profile.

The bridge deck is of standard beam and slab construction comprising 3 no. precast prestressed concrete U shaped beams, with an in situ concrete deck slab. The 1.4m deep beams, together with the in situ slab of approximately 250mm average thickness, provide a total structural depth of 1.65m and a total deck width of 7m (6m deck width between parapet rails).

The bridge substructure will be of in situ concrete construction. The typical piers and abutment supports will have a slender simple wall form (pattern printed) of constant width (approximately 1.2m) and length of approximately 2.9m. The bridge deck is detailed as integral (without mechanical bearings) as far as practicable across its length in order to minimise future maintenance needs. Mechanical bearings will be required however at both Quay abutment supports.

The bridge piers will be supported on pile caps located below the low water mark. 750mm diameter vertical and inclined steel cased bored concrete piles are proposed with the number of piles varying at each substructure to suit the loading requirements. Based on the available ground investigation data at the constraints stage, piles will have an average length of 17 to 18m assuming a bedrock level of 17.7mOD.

The proposed fixed bridge has a maximum vertical navigation clearance of 5.1m at daily low water over a 25m navigation channel, allowing the passage of small crafts. The proposed bridge layout and cross section of Bridge Option 3 are presented in Figures 3.5 and 3.6 of Volume 3 of this EIAR.

Bridge Option 4 – Aesthetic Fixed Bridge

This option is as per Option 2 except the central span is fixed (i.e. not opening to allow the passage of larger vessels). The proposed fixed bridge has a maximum vertical navigation clearance of 7.8m at daily low water over a 25m navigation channel, allowing the passage of small vessels. The proposed bridge layout and cross section of Bridge Option 4 are presented in Figures 3.7 and 3.8 of Volume 3 of this EIAR.

Bridge Option 5 – Alternative Aesthetic Fixed Bridge

Bridge Option 5 is an alternative simplified aesthetic fixed bridge with a more conventional deck and pier supports in comparison to Option 4.

The deck alignment is straight on plan and follows a constant gradient of 1.2% (1 in 83 slope) rising from the South Quay landing area (+3.5mOD) to the proposed North Quay plaza (+6.05mOD). The perceived length of the 6m wide x 217m long crossing has been reduced with the introduction of a feature flat arch located centrally in the deck at the bridge central span location. Bespoke 1.4m high metal parapets are provided along both edges to suit cycle requirements and will be fitted with wind shielding where required.

The 5 span steel bridge deck has been laid out symmetrically and comprises of a 80m long central span, two interior spans and two end spans of 40m and 28.5m lengths respectively. The 7m deck structural width is made up of a 2.5m wide main trapezoidal shaped box girder with varying depth transverse cantilevers extended 2.25m either side to the deck edges. The main box girder has a constant depth of 2m over the end spans and a variable depth over the central and interior spans with a maximum depth of 3.6m at the central supports and 2m at midpoint of the central span respectively.

The bridge substructure will be of in situ concrete construction. The piers and abutment supports will have a slender simple wall form (pattern printed) of constant width (approximately 1.2m) and length of approximately 2.9m. The bridge deck is detailed as integral (without mechanical bearings) as far as practicable across its length in order to minimise future maintenance needs. Mechanical bearings will be required however at both Quay abutment supports.

The bridge piers will be supported on large pile caps located below the low water mark. 750mm diameter vertical and inclined steel cased bored concrete piles are proposed with the number of piles varying at each substructure to suit the loading requirements. Based on the available ground investigation data at the constraints stage, piles will have an average length of 17 to 18m assuming a bedrock level of 17.7mOD. The proposed bridge layout and cross section of Bridge Option 5 are presented in Figures 3.9 and 3.10 of Volume 3 of this EIAR.

3.5 Multi-criteria Analysis Applied

Each of the five bridge options proposed are rated based on the following criteria, upon which the preferred bridge option is selected. A detailed description of the criteria is provided in the following sections of the report.

- Aesthetic Merit and Appropriateness;
- Environmental Impact;
- Durability and Future Maintenance Needs;
- Buildability;
- Construction and Whole Life Costs;
- Hydrology and Hydraulics;
- Navigation Considerations;
- Integration with Flood Defence Scheme;
- Disruption/Impact during Construction; and
- Safety.

3.5.1 Aesthetic Merit and Appropriateness

The River Suir Sustainable Transport Bridge is an integral part of the Waterford North Quays Redevelopment Project. An understanding and appreciation of the proposed bridge location, connectivity requirements and tie-in points at both quays is critical in determining a suitable form for the bridge in this urban environment. The bridge must be fully integrated with the North and South Quays forming a continuous link from Barronstrand Street at the 19th Century Gothic Clock Tower, to the central zone of the future North Quays development at a proposed plaza adjacent to the relocated train station.

With due regard to the importance of the bridge's aesthetic merit and appropriateness, Roughan & O'Donovan Consulting Engineers and Knight Architects developed suitable bridge option designs for the aesthetic bridge options 2 and 4 and aesthetic aspects of functional bridge options 1, 3 and 5. The aspiration is to deliver a bridge that acts as a high quality public realm and the appearance of which is simple, elegant and sympathetic to its historical location and topographical setting.

The following subsections describe how aesthetics were taken into consideration for the various bridge options.

Bridge Options 1 (Functional Opening Bridge) and 3 (Functional Fixed Bridge)

Deck aesthetics for this bridge option have been optimized as far as practical using standard cost effective bridge components. The deck beams have been set back from the deck edge to provide a shadow in order to reduce the perceived structure depth and in conjunction with the inclined sides of the U shaped beam construction and a constant deck depth throughout provides an agreeable appearance to the functional bridge deck suitable for the surrounding built environment.

The number of piers have been minimised as far as practicable and are spaced with reducing spans towards the banks to improve the elevation aesthetics. In conjunction with a slender pier profile (with the exception of the opening span bridge support) and patterned recessed concrete finish used to break up the perceived width, the bridge substructure provides a suitable response to the river environment. For option 1, the profile of the opening span bridge support has been reduced as far as practicable and shaped to form a family of pier supports with the other intermediate piers, limiting the aesthetic and river environment impact.

High quality detailing has been employed on the deck environment with bespoke parapets which are open in appearance facilitating views of the river and the city. In addition, discrete glass wind shielding integral with the parapet will be provided in response to the prevailing wind. An integrated parapet handrail and deck Light-Emitting Diode (LED) lighting system will be employed to provide an exciting night time illumination scheme.

An adequate bridge width (6m) has been provided for the envisaged pedestrian and cyclist traffic. The provision of occasional rest stop seating within this width is feasible which in turn will break up the visible length of the crossing. Alternatively, widening of the bridge to accommodate these seating areas is also an option should a constant footway width need to be a maintained. A constant 1.2% fall is provided from the north to the south bank. This has been selected as the best solution for the bridge in terms of creating a balance between both quays while, at the same time, providing a solution to the significant level difference of approximately 2.5m between riverbanks. Alternatives are also feasible with a high point adjacent to the end of the opening span approximately 90m from the north bank providing a 1% fall to the north and approximately 3% to south. The bridge lands at close to the South Quay existing level, minimising the required length of approach structure and therefore will not detract from the adjacent Clock Tower and historic buildings.

This option provides a simple cost effective design solution suitable for the city environment and future development of the North Quays.

Bridge Options 2 (Aesthetic Opening Bridge) and 4 (Aesthetic Fixed Bridge)

Careful consideration has been given to the architectural design of these bridge options and it has been designed to enhance the user experience of the crossing as well as enhancing the long views from the length of both quays.

The perceived length of the 6m wide x 217m long crossing has been reduced with the introduction of feature arches/viewing points at approximately the bridge 1/3 points in conjunction with a varying footway vertical profile which forms a smooth curve in elevation.

The inclined struts of the main span piers which connect in line to the architectural arches above the deck, are the main aesthetic features of these bridge options. Of additional interest is the asymmetric nature of the bridge in both elevation and cross section due to the arches being on either the east or the west side at the central span locations only. These architectural feature arches are provided with a pedestrian parapet with glass panel infill serving to provide unobstructed viewing points of the river and shielding areas for the users during adverse weather conditions. The span lengths increase from the ends to the central span, providing a structured and symmetrical layout. This, in conjunction with a shallow structural depth made possible due to the U shaped configuration of deck, results in a bridge design which is aesthetically pleasing.

The typical piers and abutment supports will have a slender simple wall form (pattern printed) of constant width (approximately 1.2m) and length of approximately 2.9m and provide minimal intrusion into the river environment.

The hidden lifting span mechanics for the opening version of the bridge embedded within the depth of the bridge deck, provide a discrete and interesting solution to the required navigational channel.

High quality detailing has been employed on the deck environment with integrated handrail LED deck lighting system and feature lighting of the arch features. Adequate bridge width is provided for the provision of seating at the arch locations. Alternatively widening of the bridge to accommodate these seating areas is feasible at the arch locations should a constant footway width need to be maintained. A 1% fall is provided to the north of the north main pier and a 1.77% fall is provided to the south of the north main pier. This has been selected as the best solution for the bridge in terms of creating a balance between both quays while, at the same time, providing a solution to the significant level difference at each bank. The bridge lands at close to the South Quay existing level minimising the required length of approach structure and therefore will not detract from the adjacent Clock Tower and historic buildings.

Bridge Option 5 – Alternative Aesthetic Fixed Bridge

A more conventional variable depth beam bridge structure with enhanced aesthetics has been selected for this bridge option. The perceived length of the 6m wide x 217m long crossing has been reduced with the introduction of feature flat arch centrally in the deck at the bridge central span location. This flat arch is adaptable to providing seating for views along the river from this central vantage point.

The span lengths increase from the ends to the central span, providing a structured and symmetrical layout which is pleasing to the eye. The main deck box section has been set back from the deck edge to provide a shadow in order to reduce the perceived structure depth and in conjunction with the box girder inclined sides and curved varying depth profile in elevation provides an agreeable appearance. The piers and abutment supports will have a slender simple wall form (pattern printed) of constant width (approximately 1.2m) and length of approximately 2.9m.

High quality detailing has been employed on the deck environment with a bespoke parapet and integrated handrail LED deck lighting system and adequate bridge width provided for the provision for occasional rest stops. Local widening of the bridge to accommodate these seating areas is also an option should a constant footway width need to be maintained. A 1% fall is provided to the north of the north main pier and a 1.77% fall is provided to the south of the north main pier. This has been selected as the best solution for the bridge in terms of creating a balance between both quays while, at the same time, providing a solution to the significant level difference at each bank.

This option provides a simple aesthetically enhanced cost effective design solution for the town environment and future development.

3.5.2 Environmental Impact

General

The construction of all bridge options will require appropriate environmental controls to be implemented in order to avoid and/or mitigate any adverse effects on the environment. A suite of mitigation measures will be defined to ensure the protection of all environmental aspects during construction and operation of the proposed development, including biodiversity, population and human health, hydrology, hydrogeology, landscape and visual, archaeology and cultural heritage, architectural heritage, air quality and climate, noise and vibration and material assets. The TII Environmental Assessment and Construction Guidelines will be followed to avoid where possible, and minimise, impacts and specific mitigation measures will be adhered to during the development of the proposal in order to reduce the impacts on all environmental receptors and particularly receptors associated with the Lower River Suir SAC (and any other potentially affected European Sites) including underwater ecology.

The overall purpose of the options stage assessment was to evaluate the potential environmental impacts associated with the bridge and to determine the varying degrees at which each of the proposed bridge options would affect the key environmental aspects.

Population and Human Health

In terms of the proposed bridge itself, it was considered that all bridge options can be considered equally beneficial as during operation they will have many positive impacts for the local community in terms of the improved pedestrian and cycle connectivity from the North Quays and Ferrybank/Bellfield areas to the City Centre and will provide opportunities for economic development of the unused Brownfield sites close to the city. The fixed bridge options would have potential adverse effects on the economy through the closure to the river upstream to navigation.

There may be some temporary adverse effects during construction; however with the application of appropriate mitigation strategies these should be minimised to an acceptable level for all bridge options. The human health and population impact of the proposed bridge on existing businesses within the city and those located along the South Quays, adjacent to the proposed development, do not vary between bridge options given that the bridge landing points are the same for all options considered.

Biodiversity

The majority of the potential adverse effects resulting from the bridge construction and associated temporary works of all bridge options will be short term and will be reversible over time. However, some aspects of the construction have the potential to have a lasting effect on biodiversity such as the permanent bridge piers which are located within the Lower River Suir SAC, the bridge deck aspect and the lighting scheme.

<u>Lower River Suir SAC</u>

The Lower River Suir SAC (Site Code 002137) is a designated site within the immediate study area. The comparison of impacts on the Qualifying Interests of the SAC due to the alternative bridge options is based on the proposed footprints of the bridge options within the SAC and the level of disturbance likely to be caused to the Qualifying Interests. Bridge options 1 to 4 each have 8 no. permanent piers in the SAC, thereby having the greatest impact on habitats and species in the SAC. In comparison, Option 5 has 6 no. permanent piers in the SAC. Therefore, it is expected that Option 5 would have the smallest footprint in the SAC during the operation phase. It is expected that Option 1 would have the greatest footprint in the SAC due to the requirement for 8 piers in the SAC and the requirement for a wide pier (approximately 10m) to house the opening bridge span. Option 3 is found to have the most straightforward construction phase due to the reduced width of the proposed cofferdams and due to the use of prefabricated superstructure elements and therefore is expected to have the least impact on the SAC during construction. Regarding impacts on the Lower River Suir SAC, it is predicted that Option 5 has marginally less impact in terms of protecting the Qualifying Interests of the SAC, followed by Options 3, 2, 4 and 1 respectively. However, see Section 3.6 on the suitability of the fixed bridge options, and Section 3.7.5 on the reduction of bridge intermediate bridge piers in the developing design.

<u>Bats</u>

There is the potential for impacts to bat roosts due to disturbance during the construction and operation phase and due to the lighting design. All bridge options have an equal deck width and will have similar levels of lighting. Therefore, for the purposes of this option evaluation study, all options are considered to have comparably equal potential impact to bat roosts.

<u>Birds</u>

The estuary is very attractive to fowl including swans, herons, ducks, lapwings, seagulls and geese. There is a potential risk posed to the flight path of birds due to the construction and operation of the proposed bridge. Options 1, 3 and 5 are relatively low lying structures (max 10m above the low water mark) and should not pose any significant barrier to the movement of birds. Options 2 and 4 are slightly higher due to the integration of arch structures however this is marginal, as the top of arch extends only 3m above the bridge parapet line (maximum 12.5m above the low water mark).

<u>Wetlands and Watercourses</u>

At option selection stage, predicted impacts or changes due to hydrological changes could include impacts on the river bed and channel likely to occur during construction and the operational phases. These impacts/changes have the potential to negatively affect the flora, fauna and water quality in the immediate vicinity of the bridge as well as downstream.

Bridge options 1 to 4 have equal numbers of permanent piers in the river (8 number). Option 5 has a total of 6 number permanent piers. It is possible that option 5 would have the least impact on the watercourse during the operational phase followed by options 3 and options 2 and 4 respectively. Option 1 would have the greatest impact due to the requirement for a wide pier (approximately 10m) to house the opening bridge span.

During construction, all bridge options would involve the installation of sheet pile cofferdams at the permanent pier locations to allow their construction. Therefore, the largest impact on the river would be during the construction phase which is likely to span a 20 – 24 month period. The cofferdam construction required for the slender 1.2m piers of all options would generally be narrow structures and would have the least impact on the river. The cofferdam construction width required to construct the central piers for options 2, 4 and 5 and the pier for the opening span for option 1 would be large structures in the order of 12-14m wide and could potentially have a significant impact on the river. Therefore, option 3 was found to have the least potential for impact on the river during construction followed by options 1 and 5 and options 2 and 4 respectively.

In addition, secondary temporary piers would be required for construction of the deck for the aesthetic bridge options (options 2, 4 and 5), however the effect of these on the watercourse is considered negligible given these would be constructed without cofferdams and would consist of small diameter piles.

Soils and Geology

It is not anticipated that there will be any significant impacts on soils and geology associated with the construction or operation of the proposed bridge and negligible difference between the options.

Hydrogeology

It is not anticipated that there would be any significant impacts on hydrogeology associated with the construction or operation of the proposed bridge and negligible difference between the options.

Hydrology

The principal potential impacts to surface water are associated with changes to the watercourse and discharges to the receiving watercourse. The varying degrees of potential impact of the proposed bridge options on the river conveyance, water levels, bed and channel (i.e., changes to the watercourse) during the operational and construction stages is based on the number and size of piers in the river channel. Bridge options 1 to 4 have equal numbers of permanent piers in the river (8 number). Option 5 has a total of 6 number permanent piers. It is possible that option 5 would have the least impact on the watercourse during the operational phase followed by options 3 and options 2 and 4 respectively. Option 1 would have the greatest impact due to the requirement for a wide pier (approximately 10m) to house the opening bridge span.

During construction, all bridge options would involve the installation of sheet pile cofferdams at the permanent pier locations to allow their construction. Therefore, the largest impact on the river would be during the construction phase which is likely to span a 20 – 24 month period. The cofferdam construction required for the slender 1.2m piers of all options would generally be narrow structures and would have the least impact on the river. The cofferdam construction width required to construct the central piers for options 2, 4 and 5 and the pier for the opening span for option 1 would be large structures in the order of 12-14m wide and could potentially have a significant impact on the river. Therefore, option 3 was found to have the least potential for impact on the river during construction followed by options 1 and 5 and options 2 and 4 respectively.

In addition, secondary temporary piers would be required for construction of the deck for the aesthetic bridge options (options 2, 4 and 5), however the effect of these on the watercourse is considered negligible given these would be constructed without cofferdams and would consist of small diameter piles.

During the operation phase it is considered that there will be no impact on the existing water quality of the receiving environment resulting from discharges to the River Suir watercourse from the bridge structure. All options during construction would have a similar potential effect on the water quality. The control of this is addressed using the standard guidelines.

Air Quality and Climate

All bridge options would have similar impacts on air quality and climate during both construction and operational phases and there would be negligible difference between the options.

Noise and Vibration

It is considered that the operation of the proposed bridge would have no significant noise impacts. Potential was found for short term noise impacts at sensitive receptors during the construction phase. The sensitive receptors primarily identified were the Granville Hotel, the Cathedral of the Most Holy Trinity and shops in the vicinity of the site on the South Quays, as well as garage, dwellings and shops in the vicinity of the site at the North Quays. At the North Quays the nearest residential area is within 50m of the site; thus there would be a significant risk of site work causing noise and vibration to impact on these receptors.

All bridge options would have a similar extent of work (and therefore noise and vibration) required to complete the bridge abutments and bridge piers closest to the river banks. The bridge decks for all options would be prefabricated off site to a large extent. A larger number of vehicular traffic movements would be expected for bridge options 1 and 3 given the larger number of individual beams and in-situ deck operations.

Archaeological and Cultural Heritage

Waterford is Ireland's oldest city, founded by the Vikings, with the River Suir estuary developing into a busy port. Waterford City is home to rich archaeology and cultural heritage. All bridge options are largely similar in terms of footprint and potential for impact on unknown archaeology. Options 1-4 have 8 foundations whilst option 5 has 6 foundation locations. Therefore, Options 1-4 have a slightly greater footprint with increased potential for coming across buried or uncovered remains or artefacts.

Architectural Heritage

Waterford City is home to rich architectural heritage. The Quays are of particular significance to Waterford City, as they formed the hub of the City's prosperity and impetus for development. The South Quays are designated as two separate Architectural Conservation Areas (ACA); namely the "South Quays" ACA and the "Trinity Within" ACA. The proposed bridge is within the South Quays ACA. All options are considered to have similar impacts and therefore there is negligible difference between the options.

Landscape and Visual Impact

For the proposed bridge, the project brief calls for:
"*A simple, elegant solution that is sympathetic to its historic location and topographical setting as well as enhancing the long views from the length of both quays*".

<u>Bridge Options 1 (Functional Opening Bridge) and 3 (Functional Fixed Bridge)</u>

The fixed bridge options 1 and 3 are of simple form, so as not to distract from the current urban environment in which they will be located.

<u>Bridge Options 2 (Aesthetic Opening Bridge) and 4 (Aesthetic Fixed Bridge)</u>

In terms of visual impact, the aesthetic bridge options 2 and 4 provide a solution with two main aesthetic features: the inclined piers; and the architectural arches over the two main piers. Aside from these features, the bridges are of simple form. These bridges also incorporate two viewing bays along their spans – one west and one east, enhancing the user experience of the surrounding environment.

Bridge Option 5 (Alternative Aesthetic Fixed Bridge)

In terms of visual impact, the aesthetic bridge option 5 provides a solution with the main aesthetic feature being the tapered bridge deck which increases in depth over the two main piers. Aside from this, the bridge is of simple form.

Therefore, it is considered that the aesthetic options of Option 2, 4 and 5 are preferred to the functional options of Options 1 and 3.

Material Assets

As the proposed development is within Waterford City, no impacts on agronomy will occur as a result of any of the proposed bridge options. As noted in the paragraph above on Population and Human Health, the impact of the proposed bridge on existing businesses within the City and those located along the South Quays, adjacent to the proposed development are also equal given that the bridge landing points are the same for all options considered. All of the lands on both the North and South Quays are owned by WCCC, therefore the only affected lands are the riverbed which will be the subject of a separate foreshore lease and the marina (Pontoon C) at the location of the proposed bridge crossing. All options are considered to have a largely similar effect.

Environmental Conclusion

Generally, all options have similar impacts on the SAC. Option 5 has marginally better environmental characteristics and would be the preferred option, followed by Options 3, 2, 4 and 1 respectively. However, see Section 3.6 on the suitability of the fixed bridge options, and Section 3.7.5 on the reduction of bridge intermediate bridge piers in the developing design.

There are no differing impacts predicted between the options on many of the environmental topics including population and human health, bats, soils, geology, hydrogeology, hydrology, air quality and climate and architectural heritage and material assets.

3.5.3 Durability and Future Maintenance Needs

Access during future maintenance and inspections can constitute a large percentage of the total cost of these operations. For this reason adequate access provisions have been considered for the bridge options during their initial development. This has been ensured through the provision of adequate deck width and load carrying capacity to accommodate suitable mobile access or under-slung platforms to allow work to be carried out safely and cost effectively without the requirement for bespoke scaffolding or other means of access.

All of the options considered and presented in this report will be designed to be durable in order to achieve the required 120 year design life. The major bridge components will however need maintenance/ replacement during this period.

The specification of suitable materials and detailing will enhance durability and reduce the maintenance liability. The following measures are proposed where relevant for each bridge option;

- Provide high strength concrete with a minimum of 50% ground granulated blast-furnace slag (GGBS) cement replacement which increases the durability in a marine environment.
- Exposed concrete may be surface impregnated with a hydrophobic pore liner where stainless steel reinforcement is not provided to reduce the potential for the ingress of water and corrosion of the reinforcing steel.
- Buried concrete surfaces will be waterproofed.
- The provision of stainless steel reinforcement in elements that are subject to the tidal river and splash zone and footway de-icing salts may be considered. Alternatively, higher strength concretes and increased cover to concrete give excellent durability characteristics.
- Provision of a through deck drainage system which will significantly reduce maintenance requirements.
- Bridge deck to be waterproofed with a spray applied system.
- A painting system will be applied to all exposed structural steelwork, which gives a minimum period to major maintenance of 25 years.
- The provision of integral connections between the bridge deck and substructure removing the need for bearings where practicable which are a maintenance issue and require replacement in order of every 20-30 years. Typically structures in excess of 60m are articulated with bearings however it is deemed feasible to make the bridge integral over the majority of the pier supports as described in detail below.
- The concrete pile supports could be steel cased and designed without the inclusion of the steel casing capacity. This steel casing will significantly reduce the length of time the concrete pile will be potentially exposed during the bridge design life therefore increasing the structure durability.

Bridge Options Maintenance Requirements

Substructure – The substructure for all bridge options consists of reinforced concrete. The reinforced concrete will be designed for durability with provision of stainless steel reinforcement or higher-grade strength concrete and enhanced cover in tidal and splash zones, and therefore should not incur any substantial maintenance requirements. Bridge option 1 has the greatest substructure concrete surface area to maintain followed by options 2 and 4, option 5 and option 3 respectively.

Bearings and Joints – All bridge options are provided with bearings and movement joints at their abutments. It is anticipated that 4 number bridge bearings (2 number at each abutment) will be required. Option 1 will have the additional maintenance liability of bearings at the two opening span pier support points. The bridge will be designed to accommodate their regular replacement. The provision of these components at the end supports will require the provision of abutment galleries in accordance with National Road Authority (NRA) BD57/01 to allow full inspection, maintenance and replacement. The remaining connections between the intermediate piers and deck will be made integral.

Superstructure – The concrete elements of Options 1 and 3 are expected to require minor concrete repairs every 15-20 years over the life span of the bridge. Major maintenance is not expected over the life of the bridge. The concrete bridge elements will have a reduced maintenance liability in comparison to the steel structure options. The steel elements of bridge options 1, 2, 4 and 5 are expected to require minor maintenance after 12 years with complete replacement of the paint finish after 25 years. The extent of maintenance repairs are likely to be more substantial and frequent for Option 5 given that sections of span are located within the river tidal range. Access will also be more difficult at these locations. It is envisaged that the interior of the steel deck box options will be protected against corrosion by utilising a dehumidification system which will be subject to a regular maintenance regime.

Parapets – Options 1, 3 and 5 will have parapets fabricated from aluminium or stainless steel construction, limiting maintenance to local repairs of the system over the life of the bridge. The parapets for Options 2 and 4 form part of the structure and will require painting in line with the remainder of the deck superstructure.

Lifting Span Mechanical and Electric Equipment (Option 1 and 2 only) – The equipment will require regular maintenance. The principle mechanism is expected to last for the life of the bridge with component replacement as required. Access for maintenance and repair for Option 1 will be more straightforward via access into the bascule pier as opposed to Option 2 which will require the use of mobile access or under-slung platforms.

3.5.4 Buildability

Construction of any structure requires careful consideration of the anticipated construction sequence to ensure that risks that may arise from the preferred design are either eliminated or, where this is not possible, they are mitigated to reasonably practicable levels and identified to the Project Supervisor for the Construction Stage so they can be effectively managed. This section provides an outline indicative construction sequence to inform the feasibility or otherwise for each of the options considered.

Based on the available ground conditions information at the constraints stage, it was assumed that pier and abutment structure would require piled foundations for all options. The assumption was that these would be in situ reinforced concrete bored piles constructed using a steel liner. For all bridge options, sheet pile cofferdams are envisaged for the construction of all piers. The installation of the cased bored piles will be carried out within the confines of the cofferdam. Temporary deck supports will be required for Bridge Options 2, 4 and 5 to facilitate the construction of the larger central span sections.

The functional bridge options (Bridge Options 1 and 3) require temporary deck supports at each integral pier until the in-situ concrete diaphragms are cast. These will utilize the pier pilecaps located within the cofferdam structures. At the south bank, it is required to perform some excavation works for the construction of a bankseat or piled abutment structure. This also requires the demolition of part of the existing quay wall to accommodate the foundations. At the north bank, the foundations will be constructed as an abutment wall resting on a pile cap above bed level, and will tie in to the existing quay structure. The future North Quays development plaza will tie in with the north bridge landing.

Earthworks import and removal volumes relating to all bridge options will be small in scale and limited to the South Quays works.

The assumed construction sequence was outlined for each bridge option, outlining the works proposed for the South Quays, North Quays, in river works (to include permanent piers and deck construction) and bridge finishes works.

Whilst all options are buildable using standard forms of construction, Options 1 and 3 have a greater ease of construction due to more straightforward site connections and more manageable prefabricated superstructure elements in comparison to Options 2, 4 and 5.

3.5.5 Construction and Whole Life Costs

The estimates of construction cost are based on measurement of quantities of the developing bridge design options determined following initial review and analysis of the structural forms.

The cost estimating is on a unit-price type estimate; whereby the unit price values were derived from a combination of historical price information from other similar river crossing projects and project specific price information from potential suppliers. The unit prices (for items such as cubic meter cost of concrete, steel, etc.) reflect the manner in which construction projects such as this are bid. These costs, therefore, reflect a summary of a large number of items related to that particular element of construction. Some judgment was applied in the use and adjustment of historical unit costs to account for differences between past projects and the specific conditions for the proposed River Suir Sustainable Transport Bridge.

A comparative summary of the initial construction costs for the various bridge options are shown in Table 3.1 and Table 3.2. It is also necessary to consider operational and maintenance costs to determine the life-cycle costs involved for the proposed River Suir Sustainable Transport Bridge. Life cycle cost represents the future anticipated expenditures to maintain the bridge over its service life of 120 years. The future expenditure includes such items as routine inspection costs, replacement of bridge elements that wear out and need to be replaced, such as the bearings, joints, etc. Other items that have a service life less than the bridge and will need to be replaced are also included. An additional allowance is included for general maintenance and repairs over time are also included. The life cycle cost in this evaluation follows best international practice.

The Whole Life Costs Comparison, initial capital investment; i.e., construction costs and life cycle costs, for the bridge options are illustrated in Table 3.1 and Table 3.2 below.

Bridge Options 1 (Functional Opening Bridge) and 3 (Functional Fixed Bridge)

These options have the lowest initial capital costs, due to their simplicity of construction and modest functional structural form. Bridge Option 3 is the most economic solution due to the fact that it is a fixed bridge with no opening span, negating the need for expensive lifting mechanisms. The cost related to any third party agreements required to close the channel to navigation have not been included in this cost estimate. Bridge Option 1 is next in line in terms of construction cost however, as can be seen from Table 3.1, it is in the region of 64% more expensive than Option 3 due to the provision of an opening span and associate large bascule pier required to house the lifting mechanisms. The 93% difference in whole life costs estimates between options 3 and 1 relate mainly to the operation and servicing of the opening span.

Bridge Options 2 (Aesthetic Opening Bridge), 4 (Aesthetic Fixed Bridge) and 5 (Alternative Aesthetic Fixed Bridge)

These options have higher initial capital costs due to their complexity of construction and importance given to aesthetic design. Additional construction costs relating to Option 2 are due to the opening functionality of the bridge. Whole life costs for Options

4 and 5 are comparable with an increase noted for Option 2 relating mainly to the operation and servicing of the opening span.

Table 3.1 Construction Cost and Whole Life Cost Comparison

Item	Cost Comparison				
	Option 1	Option 2	Option 3	Option 4	Option 5
Total Construction Cost	+64%	+133%	Most Economical	+90%	+81%
Whole Life Cost	+93%	+128%	Most Economical	+53%	+41%
Construction + Whole Life Cost	+66%	+132%	Most Economical	+88%	+79%

Table 3.2 Construction Cost and Whole Life Cost Ranking (Ranking: 1 most economical – 5 least economical)

Item	Cost Ranking				
	Option 1	Option 2	Option 3	Option 4	Option 5
Total Construction Cost	2	5	1	4	3
Whole Life Cost	4	5	1	3	2
Construction + Whole Life Cost	2	5	1	4	3

3.5.6 Hydrology, Hydraulic and Navigation Considerations

The bridge must be capable of passing a fluvial flood flow with a 1% annual exceedance probability (AEP) or 1 in 100 year flow. In addition to the above fluvial flood flow standard, as the bridge is within a tidal zone, it must cater for a tide level with a 0.5 % AEP or 1 in 200 year flow without significantly changing the hydraulic characteristics of the watercourse. In addition, it must be demonstrated that the new structure does not increase the risk or magnitude of flooding upstream or downstream of the proposed structure.

The design flood level (200 year tide and 100 year fluvial flood) for the River Suir at Waterford North Quays is 3.47mOD as outline in the report "Waterford North Quays Strategic Flood Risk Assessment (SFRA), October 2017".

The various bridge options considered affect the hydraulic and navigational functionality of the river to varying degrees and are outlined in the following subsections.

Navigational Functionality

Bridge Option 1 performs best in terms of navigational considerations, providing the greatest opening span clearance of 26m, with no vertical clearance restrictions, allowing for the passage of large crafts.

Bridge Option 2 performs well in terms of navigational considerations, providing an opening span clearance of 14m, with no vertical clearance restrictions. Options 3, 4 and 5 are fixed bridges with no opening span, and therefore have limited navigational clearances. The passing of small crafts will only be feasible with vertical clearances to the underside of the deck at low tide of 5.1m, 7.8m and 5.2m for Options 3, 4 and 5 respectively.

Impact on River Hydrology and Hydraulics

In terms of hydrology and hydraulics, Option 1 will have the worst performance due to the 6 number intermediate piers, an abutment structure and a large bascule pier within the river channel. Although the bridge substructure provides an obstruction to flow, the overall reduction of river cross section is only in the region of 8%. Therefore, it is not anticipated to have any marked impact on conveyance or estuary levels upstream or downstream of the bridge.

Bridge Option 5, although having few supports, has an approximately similar impact due to the tapered nature of the bridge deck structure. Bridge Options 2 and 4, with 8 pier/abutment structures of a smaller scale, have a slightly lesser impact than Options 1 and 5 with an overall reduction of river cross section in the region of 5%.

Bridge Option 3 performs the best due to the use of narrow piers at all internal supports.

3.5.7 Integration with Quays and Flood Defence Scheme

South Quays

All bridge options will integrate with the South Quay landing area (current Clock Tower carpark) and flood wall system in a similar fashion. Traffic access protection bollards shall be provided at the access point to the bridge at the South Quays tie-in.

To allow for the bridge abutment and approach ramp construction, sections of the quay wall and its glass flood barrier system will need to be altered. Depending on the plan extents of the bridge approach structure, it is expected that the extents of quay wall affected will be in region from 10 to 40m. The line of the bridge affects the existing jetty structure just north of the quay wall. Remedial works to the jetty and its access points or full demolition of the jetty will be required. In addition there are several small buildings adjacent to the Clock Tower which may require demolition to accommodate the bridge approach structure. The structure will consist of a system of ramps (maximum of a 1 in 20 slope) and stairs to accommodate the level difference of approximately 1.3m between the bridge end and the existing carpark level. The reinstated quay and glass flood wall (top of wall approx 4mOD) will tie in with the bridge approach structure and bridge parapets to reinstate the flood wall system. The structure will integrate with future street upgrade proposals for Barronstrand Street, the bridge lighting scheme/ detailing will comply with all current WCCC streetscape standards and building regulation.

North Quays

The North Quays landing level of 6.05mOD is well above the 1 in 200 flood level and poses no issue to any flood defences along these Quays constructed as part of the future development. The north approach will form part of the future development and will need to be integrated with the bridge proposals and accommodate all future bridge maintenance and inspection requirements (i.e. bridge movement joints, bearings and abutment structure). Traffic access protection bollards shall be provided at the access point to the bridge at the North Quays tie-in.

3.5.8 Disruption/Impact during Construction

It is considered that an 18-24 month construction period would be required for the bridge construction, subject to the form of structure progressed to design. Construction activities on the South Quays will be arranged to limit disruptions to road traffic and pedestrian along the South Quay.

The vast majority of the construction traffic activity will be concentrated on the north side of the river with access likely limited to routes from the N25/N29 along the R448 or R711. Access to the south side site will likely be from across Rice Bridge and then along Meaghers/Merchant Quay (R680).

All options will have a similar level of impact to road traffic with similar levels of vehicle movements expected from each site on the north and south of the river.

Impact on river traffic during construction will be dependent on the type of bridge (fixed or opening) selected by WCCC. The provision of an appropriate navigational channel in the 220m wide estuary should not be an issue during construction.

3.5.9 Safety

During the development of the options, particular risks have been identified and, where possible, these have been eliminated. Residual risks that have not been eliminated are given below.

The following risks have been identified in the second Schedule of the Safety, Health and Welfare at Work (Construction) Regulations:

- work which puts persons at work at risk of falling from a height;
- work which puts persons at work at risk of burial under earthfalls;
- work which puts persons at work at risk of engulfment in swampland;
- work which puts persons at work at risk from chemical or biological substances;
- work exposing persons at work to the risk of drowning; and
- work involving the assembly or dismantling of heavy prefabricated components.

Further residual risks resulting from the proposed options identified at this stage include the following:

All Options

- Transportation and lifting of significant prefabricated elements;
- Traffic Management;
- Unauthorised access to the site;
- Diversion of services;
- Noise and Vibration;
- Handling;
- Exposure to construction plant;
- Installation and testing of piles;
- Stability of structure in temporary condition during construction;
- Deck construction over the river in a tidal zone;
- Installation of parapets/pedestrian guardrails over the river;
- Demolition activity in relation to existing quays in vicinity of the proposed bridge;
- Risk of flooding during construction works;
- Risk of Weil's Disease and other mammal borne diseases;
- Activities involving exposure of workers to excessive noise;
- Risk of vessel impact under both temporary and permanent conditions;

- Offsite and onsite fabrication;
- Maintenance of concrete substructure in a tidal river;
- Extensive temporary works in river required or bridge construction;

Bridge Options 1 and 3 – Functional Opening and Fixed Bridges

- Application and maintenance of protective finishes to steelwork over water - (option 1 only);
- Construction of a large deep pier for bascule span (option 1 only);
- Maintenance/replacement of bridge bearings over water;
- Stability of large beams during erection;
- Construction of in-situ concrete deck over water;
- Temporary support of large deck sections until integral connections made.

Bridge Options 2 and 4 – Aesthetic Opening and Fixed Bridges

- Application and maintenance of protective finishes to steelwork over water - Exposure reduced adopting steel boxes;
- Temporary support of large deck sections until integral connections made with supports;
- Stability of asymmetric deck sections with arches during erection;
- Risk of accidents from people attempting to climb the arches – a suitable detail at the base of the arch would need to be developed;
- Construction large inclined pier elements;
- Temporary tie support of inclined piers until connection is made with deck.

Bridge Option 5 – Alternative Aesthetic Fixed Bridge

- Application and maintenance of protective finishes to steelwork over water - increased risk over other options due to steelwork within the tidal zone. Exposure reduced adopting steel boxes;
- Temporary support of large deck sections until integral connections made;
- Multiple deck butt weld points require due limited capacity to lift from jack up barges;
- Stability of large deck sections during erection.

3.6 Options Evaluation Summary

In order to determine the preferred bridge option, all the bridge designs were evaluated in relation to the various multi-criteria identified. The options have been evaluated using the simple scale of least preferred, intermediate and preferred. Where all options are equal this is noted. The evaluation of bridge options is summarised in Table 3.3 and Table 3.4. The colours are included in the table as a visual aid to clarify this selection process.

On examination, Table 3.3 reveals that Option 2 and Option 3, are the preferred options for the opening and fixed bridges respectively. However, following consultation with river users and a number of Consultees during the option evaluation process, it was agreed with WCCC, that navigation on the river could not be eliminated and therefore an opening bridge should be selected to allow unrestricted passage for vessels. As a result, Option 2 was therefore selected by WCCC in January 2017 as the preferred option to progress to the preliminary design stage.

In conclusion, the MCAMCA has identified Option 2 as the preferred bridge option for the River Suir Sustainable Transport Bridge as it is the preferred option on all grounds (with the exception of navigation) including most critically from an Environmental perspective.

Table 3.3 Summary Comparison of Bridge Options Considered (Stage 1 Assessment – All options)

Criteria	Bridge Options				
	Opening Bridges		Fixed Bridges		
	Option 1	Option 2	Option 3	Option 4	Option 5
Aesthetic Merit and Appropriateness	Least Preferred	Preferred	Intermediate	Preferred	Intermediate
Environmental Impact	Least Preferred	Intermediate	Intermediate	Intermediate	Preferred
Durability & Structure Future Maintenance	Least Preferred	Intermediate	Preferred	Preferred	Intermediate
Buildability	Intermediate	Intermediate	Preferred	Intermediate	Least Preferred
Whole Life Costs	Least Preferred	Least Preferred	Preferred	Intermediate	Intermediate
Hydrology and Hydraulics	Least Preferred	Intermediate	Preferred	Intermediate	Least Preferred
Navigation Considerations	Preferred	Intermediate	Least Preferred	Least Preferred	Least Preferred
Integration with Flood Defence Scheme	Equal	Equal	Equal	Equal	Equal
Disruption/Impact during Construction	Equal	Equal	Equal	Equal	Equal
Safety	Intermediate	Intermediate	Preferred	Intermediate	Least Preferred
Overall Rank	**Least Preferred**	**Intermediate**	**Preferred**	**Intermediate**	**Least Preferred**

See Table 3.4 overleaf for Stage 2 Assessment.

Table 3.4 Summary Comparison of Opening Bridge Options Considered (Stage 2 Assessment – Opening Bridge options)

Criteria	Bridge Options	
	Opening Bridges	
	Option 1	Option 2
Aesthetic Merit and Appropriateness	Least Preferred	Preferred
Environmental Impact	Least Preferred	Preferred
Durability & Structure Future Maintenance	Least Preferred	Preferred
Buildability	Equal	Equal
Whole Life Costs	Equal	Equal
Hydrology and Hydraulics	Least Preferred	Preferred
Navigation Considerations	Preferred	Least Preferred
Integration with Flood Defence Scheme	Equal	Equal
Disruption/Impact during Construction	Equal	Equal
Safety	Equal	Equal
Overall Rank	**Least Preferred**	**Preferred**

3.7 Design Development of Preferred Option 2 to Preliminary Design

3.7.1 Navigational Clearance

Design Option 2 provided an opening span with a navigational channel width of 14m. Further to consultations with river users and Consultees, and approved with WCCC, the developing design navigational channel provision was increased to be an opening clearance not less than that of the upstream Rice Bridge. A revised horizonal navigational clearance of 25m was therefore progressed to the Preliminary Design Stage.

3.7.2 Bridge Width and Functionality

Following consultation with the NTA and WCCC, it was recognised that the bridge crossing should be utilised to accommodate an electric bus route (see Section 3.8). In addition, instead of the shared-use bridge deck, it was determined to segregate a pedestrian corridor from cyclist and buses. This resulted in a pedestrian corridor of minimum 3.0m width with a 0.5m urban designed planter buffer zone. The combined cyclist and bus corridor shall have a minimum width of 4.5m. The developing design shall have a combined minimum total width of 8m.

Additionally, to enhance user comfort and user safety conditions, the bridge deck shall provide tapered bridge access, localised viewing platforms and sheltered seating arrangements. These localised widened deck features shall allow users to observe the surrounding sites along the north and south quays thereby enhancing the users experience of the bridge, as well as allow for greater user accessibility.

3.7.3 South Quay Plaza Urban Design

At the South Quay Plaza it was initially assumed, at the early options appraisal stage, that the bridge landing access would provide an integrated design with existing parking. However, this design concept has been replaced with the provision of landscape areas and urban design features at the South Quay Plaza. A plant room / building was also developed for the South Quays.

3.7.4 North Quay Tie-in Level

At the North Quay Plaza it was an initial design requirement, at the options stage, that the bridge tie-in level should be +6.05mOD. However, following consultation with the SDZ developer, to accommodate the future development of the North Quay Plaza a revised tie-in level of +8.00mOD was deemed required.

In order to accommodate the higher +8.00mOD North Quay tie-in level the vertical alignment of the bridge was required to be altered from that at the options stage. The options design vertical alignment had a crest curve. For the developing design, a longitudinal fall is introduced from the high level of +8.00mOD on the North Quay tie-in to +4.425mOD on the South Quay.

The above deck arch feature in relation to the revised longitudinal fall had a negative aesthetic implication on the developing design. As part of the design development the arch feature was replaced with below deck V-shaped deck to pier structures at preliminary design gridlines C and D. The removal of the arches eliminates visual clutter and provides a more streamlined bridge structure whilst also reducing potential environmental effects in relation to possible bird strikes.

3.7.5 Intermediate Pier Support Reduction

Design Option 2 provided 6 intermediate pier supports. In order to reduce impacts on the Lower River Suir SAC and following consultations with river users, and agreed with WCCC, it was deemed necessary to reduce the number of pier supports in the river channel. The developing design has been refined to 4 intermediate pier supports in the river channel. This was considered as an enhancement from an environmental perspective.

3.8 Bus Route Options Considered

Three alternative bus routes for the public transport vehicle were considered and assessed. These route options included:

- a route which crosses the proposed bridge, travels up Barronstrand Street and Broad Street, turns left onto Peter Street, turns right into Bakehouse Lane, turns right into Lady Lane, turns right onto Michael Street and reconnects to Broad Street/Barronstrand Street, as presented in Plate 3.1;
- a route which crosses the proposed bridge, travels up Barronstrand Street, Broad Street and Michael Street and turns at the junction of Michael Street and New Street, as presented in Plate 3.2;
- a route which travels over and back across the bridge only with the future ability to turn left onto Merchant's Quay from the bridge and to turn left onto the bridge from Merchant's Quay, as presented in Plate 3.3.

Plate 3.1 **Alternative Route Option incorporating Bakerhouse Lane**

Plate 3.2 **Alternative Route Option to junction with New Street**

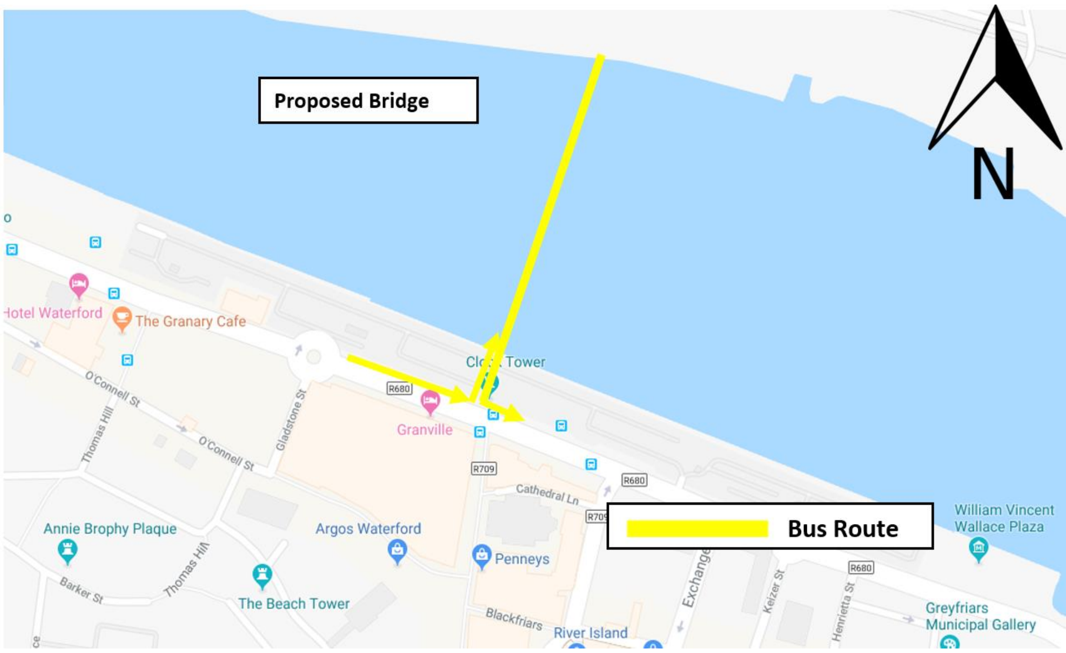

Plate 3.3 **Alternative Route Option across the proposed bridge with left hand turn onto the bridge from Merchant's Quay and a left hand turn onto Merchant's Quay from the bridge**

The route which travels over and back across the bridge emerged as the preferred electric shuttle bus route option, as presented in Plate 3.3. The turning movement of the electric vehicle on the south quay is presented in Figure 4.6 of Volume 3. An objective of the project is to link the north and south quays and this route fulfils this objective with the least disturbance to the surrounding area. The proposed bus route will connect Waterford City centre with the North Quays SDZ, thereby connecting two key retail facilities. The proposed bus route will provide a connection between these areas for the young, old and mobility impaired, for whom cycling and walking are not available.

This route option has been assessed in this EIAR, however there is potential for the bus route to be extended to service a wider catchment area in the future, for example to the Viking Triangle tourist attraction to the south and to schools, houses and community facilities in Ferrybank to the north.

The Selected bus route is not considered to have any adverse effects on the environment and with the future ability to

3.9 Electric Vehicle Options Considered

The following seven bus types were considered as options for the mode of public transport crossing back and forth across the proposed bridge:

- MotoEV Electro Transit Buddy 15 passenger hard door Americans with Disabilities Act (ADA) shuttle;
- MotoEV Electro Transit Buddy 12 passenger hard door shuttle-short;
- MotoEV Electro Transit Buddy 15 passenger XE hard door shuttle;
- A CitEcar Electro Transit Buddy 15 passenger hard door ADA Shuttle;
- Bintelli ADA Enclosed Shuttle 11P 1WC;
- Phoenix Zeus Electric Shuttle Bus; and
- EasyMile EZ10

These options are discussed and compared and their suitability for use on the proposed bridge is identified.

3.9.1 MotoEV Electro Transit Buddy 15 passenger hard door ADA shuttle

The wheelchair accessible, 15 passenger MotoEV Electro Transit Buddy is a manual, electric vehicle with a range of 80km at full capacity. The vehicle is approximately 5m in length, 1.5m in width and 2m in height and has a turning radius of approximately 5.5m. An image of the vehicle is presented in Plate 3.4.

Plate 3.4 MotoEV Electro Transit Buddy 15 Passenger Hard Door Wheelchair-Friendly Shuttle

3.9.2 MotoEV Electro Transit Buddy 12 Passenger Hard Door Shuttle-Short

The manual, electric MotoEV Electro Transit Buddy is capable of carrying 12 passengers. The vehicle is not accessible to wheelchairs. It is approximately 4.2m in length, 1.5m in width and 1.9m in height and has a turning radius of approximately 4.6m. The vehicle has a range of 80km at full capacity. An image of the vehicle is presented in Plate 3.5.

Plate 3.5 MotoEV Electro Transit Buddy 12 Passenger Hard Door Shuttle-Short

3.9.3 MotoEV Electro Transit Buddy 15 Passenger XE Hard Door Shuttle

The manual, electric MotoEV Electro Transit Buddy is capable of carrying 15 passengers. The vehicle is not accessible to wheelchairs. It is approximately 5m in length, 1.5m in width and 2m in height and has a turning radius of approximately 5.5m. The vehicle has a range of 80km at full capacity. An image of the vehicle is presented in Plate 3.6.

Plate 3.6 MotoEV Electro Transit Buddy 15 Passenger XE Hard Door Shuttle

3.9.4 CitEcar Electro Transit Buddy 15 Passenger Hard Door ADA Shuttle

The manual, electric CitEcar Electro Transit Buddy is capable of carrying 15 passengers. The vehicle is accessible to wheelchairs. It is approximately 5.1m in length, 1.5m in width and 1.9m in height and has a turning radius of approximately 5.5m. The vehicle has a range of 80km at full capacity. An image of the vehicle is presented in Plate 3.7.

Plate 3.7 CitEcar Electro Transit Buddy 15 Passenger Hard Door ADA Shuttle

3.9.5 Bintelli ADA Enclosed Shuttle 11P 1WC

The manual, electric Bintelli ADA Enclosed Shuttle is capable of carrying 11 passengers. The vehicle is accessible to wheelchairs. It is approximately 5.1m in length, 1.5m in width and 2m in height and has a turning radius of approximately 5.5m. The vehicle has a range of 80km at full capacity. An image of the vehicle is presented in Plate 3.8.

Plate 3.8 Bintelli ADA Enclosed Shuttle 11P 1WC

3.9.6 Phoenix Zeus Electric Shuttle Bus

The manual, electric Phoenix Zeus Electric Shuttle Bus is capable of carrying 12-20 passengers. The vehicle is accessible to wheelchairs. It is approximately 7.1m in length, 2.7m in width and 2.9m in height. The turning radius is not identified. The vehicle has a range of 160km at full capacity. An image of the vehicle is presented in Plate 3.9.

Plate 3.9 Phoenix Zeus Electric Shuttle Bus

3.9.7 EasyMile EZ10

The autonomous electric EasyMile EZ10 is capable of carrying 8 passengers. It is not clear whether the vehicle is accessible to wheelchairs. It is approximately 4m in length, 2m in width and 2.3m in height. The turning radius is not identified. The vehicle has a range of 14 hours at full capacity. An image of the vehicle is presented in Plate 3.10.

Plate 3.10 EasyMile EZ10

3.9.8 Vehicle Option Comparison and Preferred Option Selected

The MotoEV Electro Transit Buddy 12 Passenger Hard Door Shuttle-Short and the MotoEV Electro Transit Buddy 15 Passenger XE Hard Door Shuttle are not viable options as they do not have wheelchair access. The CitEcar Electro Transit Buddy 15 Passenger Hard Door wheelchair accessible shuttle and the Bintelli ADA Enclosed Shuttle 11P 1WC are not as aesthetically pleasing as the other options and therefore were both ruled out. The Phoenix Zeus Electric Shuttle Bus is a larger vehicle in comparison to the other options and is too cumbersome considering the proposed purpose and turning requirements at either end of the bridge. Therefore, this option is ruled out as a viable option. The EasyMile EZ10 is an automonous bus and therefore is not considered appropriate considering the safety risk due to the shared space between cyclists and the vehicle. Furthermore, the EasyMile EZ10 only accommodates 8 people and therefore this option was ruled out. The 15 passenger MotoEV Electro Transit Buddy 15 Passenger Hard Door ADA Shuttle is the preferred option as it is wheelchair accessible, aesthetically pleasing, manual and accommodates a sufficient number of passengers.

Chapter 4
Description of the Proposed Development

ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 4 Description of Proposed Development

4.1 Introduction

This chapter provides a description of the proposed River Suir Sustainable Transport Bridge. It is based on the design and includes details of the engineering features, land requirements and construction and operation requirements. A description of the primary elements of the design is presented in the following sections.

It should be noted that surveys, assessments and information that form the basis of this Environmental Impact Assessment Report (EIAR) are based on the design of the project as described in this chapter, which has been developed to a stage that permits a fully informed Environmental Impact Assessment (EIA) to be carried out by the competent authority. While further detailing will be required to fully inform procurement and construction, no design changes will be permitted that have the potential to undermine the basis of assessment of the environmental impacts undertaken in this EIAR.

4.2 General Description

Bridge and Scheme Description

The bridge site location is approximately in line with Barronstrand Street and in front of the existing Clock Tower, as presented in Plate 4.1. The bridge is a sustainable transport bridge which accommodates pedestrians, cyclists and an electric bus shuttle service between the north and south quays. The bridge also accommodates an opening section which facilitates navigation of vessels along the River Suir.

The proposed 5-span, 8m wide bridge (inside of parapet to inside of parapet) will accommodate pedestrians, cyclists and an electric shuttle bus service. The bridge is also locally widened in two locations (approximately located at third points across the bridge) to facilitate repose and look out areas. Cyclists and the electric shuttle bus will be facilitated through a shared-space lane, whilst pedestrians will be provided with a primarily segregated area of the deck cross-section. There are some locations at the centre of the span and the south plaza where all the spaces are shared spaces between pedestrians, cyclists and the electric bus.

Plate 4.1 Proposed Bridge Location

The proposed development also comprises a plaza at the South Quay landing point. This plaza will be a paved and landscaped space for the streetscape around the Clock Tower. There will also be lighting, flagpoles, street furniture and planting which will be subject to detailed design and is indicatively illustrated in as presented in Plate 4.2. Approximately 200 car parking spaces will be removed from the existing car parks along Merchant's Quay for the construction of the South Quay Plaza, of which approximately 150 spaces will be permanently removed. An integral part of the development of this South Plaza includes the provision of foundations and utilities for two future buildings on the South Quays. The foundations and utility provisions for the buildings are included in this Environmental Assessment Impact Report, but the buildings about ground level are not included and will be the subject of a future planning application.

Plate 4.2 Proposed South Quay Plaza

The sustainable transport bridge crossing point is approximately 550m downriver of Rice Bridge. The river is in the region of 207m wide at this location, measured between the edge of the south quay and the shore edge of the north side wharf and is part of the Lower River Suir Special Area of Conservation (SAC).

The south quays area at the proposed bridge location currently consists of the Clock Tower and car parks whilst the north quays is a former industrial brownfield site which shall be developed as a Strategic Development Zone (SDZ). There is also an existing marina located on the south quays which will be directly impacted by the proposed bridge.

River Navigation

A 25m clear span navigational channel has been provided for river vessels. The existing lifting span control building for Rice Bridge will also be used for the proposed River Suir Sustainable Transport Bridge as will be described below. Design vessel characteristics and any independent ship impact protection required along the line of the navigational channel have been discussed with the Port of Waterford. The design of the proposed vessel collision protection system is presented in Figures 4.2, 4.4 and 4.5 of Volume 3 of this EIAR and the details of which are discussed later in this chapter.

The passing of small crafts will be feasible without opening the lifting span. The bridge deck at this location will have an underside of deck level of approximately +5.22mOD (metres above Ordnance Datum Malin Head) which will provide vertical clearances of 7.42m (-2.2mOD) and 2.82m (+2.4mOD) at low and high tide respectively.

At the navigable channel, the river bed level is approximately -12mOD. The typical water depths range from 10 to 14m for low and high-tide respectively.

Effect of Bridge on River Suir

The bridge deck elevation has been profiled to allow a freeboard for both the combined 1% Annual Exceedance Probability (AEP) fluvial and 0.5% AEP tidal flood level (obtained from "*Suir CFRAM Study, Hydraulics Report, July 2015*") and the design flood level (200 year tide + 100 year fluvial flood) obtained by the hydraulic model developed for the North Quays Strategic Flood Risk Assessment (SFRA) by Roughan & O'Donovan Consulting Engineers, "*Waterford North Quays, Strategic Flood Risk Assessment",* document no. 16.169.10/SFRA 001 Rev D, dated 6th October 2018. The calculated 200-year tide combined with 100-year fluvial flood is +3.47mOD.

At the northern approach of the bridge, the deck elevation is flat, and has its highest point at the North Quay abutment (+8.00 mOD, measured at the top of the deck). The lowest point of the deck elevation is at the South Quay abutment (+4.42 mOD, measured at the top of the deck). The proposed deck elevation over the majority of the 207m span is significantly higher than the calculated extreme flood events. An OPW Section 50 report, "*Hydraulic Modelling of Proposed River Suir Sustainable Transport Bridge for OPW Section 50 Approval",* prepared for Roughan & O'Donovan Consulting Engineers by Hydro Environmental Ltd, dated December 2018, Report No. HEL212203 v1.1, has been prepared for the proposed scheme based on the bridge characteristics presented in the figures in Volume 3. The conclusions of that report state: - "*The effect of the proposed Bridge and support piers is found to have no perceptible impact on flood levels and flood risk under a range of combined tide and fluvial flood events".*

Marina Impact

There is a marina located as per Figure 4.6 in Volume 3 of this EIAR. The proposed development, i.e., the bridge alignment, cuts through this marina and hence will require the facilitation of these vessels at alternative locations and re-organisation of the existing vessel berthing arrangements within the marina. It is likely that the alternative locations for the displaced vessels will be approximately 470m downstream, adjacent to Reginald's Tower, and this will be finalised in consultation with, and agreement with, the Port of Waterford and Waterford City and County Council (WCCC). Approximately 20 berths will be permanently removed, comprising 14 long term berths and 6 visiting berths. The marina is currently at approximately 70% occupancy and receives approximately 150 visiting vessels each summer, from April to October.

An approximate length of 70.4m of the existing marina and the associated gangways of the current access to the south quays will be removed. This will incorporate the removal of 5 piles and the provision of 4 new driven piles when reconfiguring the marina. Two new access gangways will be required, one to the east and one to the west of the proposed bridge. These new gangways will require two new openings to be created in the flood wall with the existing opening being closed and made contiguous with the existing flood defence wall. Re-wiring and re-plumbing will be required for boat users during the construction phase in order to maintain their services.

4.2.1 Purpose of Providing the Proposed Development

The proposed bridge is required to stimulate the coherent development of the city's various quarters, in particular integrating the substantial housing areas in Ferrybank and Bellfield and the proposed North Quays redevelopment with the city centre. The bridge will be located in line with Barronstrand Street / the Clock Tower to provide a continuous link connecting the city centre retail spine to the North Quays.

The proposed bridge across the River Suir will be a public amenity offering greater appreciation and enjoyment of the river. In order to develop a transport facility that will permit and encourage sustainable development, a user hierarchy of pedestrians, cyclists and an electric shuttle bus service will be adopted. The proposed bridge will be a sustainable transport bridge that connects into the existing road infrastructure in a logical and safe manner. The development has been designed to take cognisance of the cycling strategy for the city and also the National Transport Authority's (NTA's) *National Cycle Manual*.

4.3 Proposed Bridge Structure

General

The River Suir Sustainable Transport Bridge is an elegant, low level bridge which provides access between both quays and has the following features:

- The bridge is quite unique for such a long bridge (and an opening bridge) in that the levels at the north and south quays are significantly different. The level at the north quays is +8.00mOD whilst the level at the south quays is substantially lower at +4.42mOD. This presented quite a challenging design constraint;
- An architectural streamlined low-level painted steel deck (superstructure);
- The structural deck cross-section incorporates vertical structural upstands, which, when combined with parapets / wind-shielding, provides a comfortable and safe setting for all bridge users;
- The bridge piers (substructure) are minimised to four discrete supports within the river channel. These consist of durable concrete marine construction;
- The architectural bridge shape is highlighted by its clear lines which define the deck and the piers;
- Cantilevered platforms will be provided at central pier locations (east above the northern central pier and west on the southern central pier) to improve the bridge viewing experience, as presented in Figures 4.2, 4.4 and 4.5 of Volume 3 of this EIAR; and
- A combined structural deck and parapet / wind shielding will be provided over the length of the bridge, which enhanced the users experience.

Span Arrangement

The bridge will be a 5-span bridge deck, laid out symmetrically and comprising a 70m long central span with an opening section, two intermediate spans of 41m and two end spans of 27.5m length. The 32.5m wide opening section of the central span is a counterweighted, hydraulically operated double leaf bascule bridge which provides a 25m wide navigational channel in its open position.

Superstructure

The bridge deck will be of painted steel construction. On the south side, the deck will have a half through configuration (U shaped) consisting of a shallow box girder over the 8m wide bridge (depth approximately 600mm) connecting to two main edge box girders (varying depth between 1.6m to 0.9m deep) on either side protruding above the top of deck level. A parapet / windshielding of variable depth will satisfy the minimum requirement of 1.4m high protection parapet throughout. The comfort and safety of bridge users (pedestrians, cyclists and electric bus users) have been carefully considered and the proposed combination of structural solid upstand and parapet / windshielding to a minimum height of 1.4m will be supplemented by further wind studies during the detailed design development to determine the optimum height and porosity of the parapets / wind shielding. This will be confirmed by both computational fluid dynamics and wind tunnel testing to determine user comfort and the effect on the electric bus (which would be considered to be a wind susceptible vehicle [WSV]).

The deck surfacing will be formed with a thin layer of resins or bituminous material which also acts as a waterproofing membrane, has high resistance to the marine environment and provides the required slip resistance for all bridge users.

At both bridge ends there is a gradual change of the deck cross section to a wider deck over the last 12m of the bridge on both the North and South Quays, as presented in Figures 4.2 and 4.5 in Volume 3 of this EIAR.

At the central piers location, two v-shaped steel legs (struts), connected over each pier, will support the deck. The legs have a box section to provide adequate stiffness without excessively increasing loads and effects to the foundations.

Substructure

The bridge piers will be of in-situ concrete construction. The main span piers will support the deck by means of inclined steel struts which are integrally connected to the steel deck and converge to a concrete diamond-shaped pier at their base. The intermediate piers will have a slender form of tapering width (approximately 1.0m at deck level and 3.0m at pile cap level) and heights of approximately 10.0m and 7.7m for the north and south pier respectively. Both central and intermediate piers will be constructed using in-situ concrete. The bridge deck is detailed as integral with these piers and it will be articulated on bearings at the abutments only.

The bridge abutments will slightly differ at the north and south ends of the bridge. At the southern end of the proposed bridge, the abutment will be of standard construction with an access gallery incorporated to allow for bearing and movement joint inspection. The southern abutment will be included in the end splay structure and will be supported above a sheet piled structure protruding in plan from the existing south quay. The northern abutment will be an isolated element from the existing north quay. It will provide a gallery for bearing replacement and inspection and will be supported on piles.

Bridge Foundations

The main bridge piers (at gridline C and D – refer to Figures 4.2, 4.3, 4.4 and 4.5 of Volume 3 of this EIAR) will be supported on pile caps with the upper surface of these at a level of -3.40mOD, approximately 1.2m below the low water mark (-2.2mOD). Ten number 1200mm diameter raking steel driven tubes with concrete rock sockets and reinforced concrete infill support the bridge at these locations.

The intermediate bridge piers will be supported directly on three number 1200mm steel driven tubes with concrete rock sockets and reinforced concrete infill.

The south abutment will be supported on a concrete plug part of the sheet piled structure. The north abutment will be supported on a number of 750mm diameter raking steel driven tubes with concrete rock socket and reinforced concrete infill.

Based on the ground investigation borehole data, pile lengths will vary considerably between the north and south bridge abutments. Pile lengths to rock at the north and south abutments will be in the region of 12m and 25m respectively. Piles will be socketed approximately 1-2m into competent bedrock.

Articulation Arrangement, Joints and Bearings

The proposed structure is structurally integral at the central and intermediate pier supports and articulated (free to move) at the north and south abutment. Two number mechanical bearings (one guided and one free) will be provided at each abutment support to allow for the expansion and contraction of the deck under various temperatures. Typical bridge movements which are expected are illustrated in Table 4.1 below.

Table 4.1 Bridge Movement Joint Range

Direction of Movement	Transverse joint (bridge deck end)
Longitudinal	+/- 65mm
Transverse	Fixed
Vertical	Fixed

Opening Mechanism

General

As noted above, it is a navigational requirement of this crossing to provide a 25m wide navigational channel to water traffic. The double leaf bascule is illustrated in Figures 4.2 and 4.4 in Volume 3 of this EIAR. It is proposed to use the existing control tower on Rice Bridge in conjunction with additional plant rooms located on the north and south quays to open the bridge. This is discussed in further detail below.

The existing control tower on Rice Bridge has good visibility of the navigational channel and when combined with CCTV at the proposed sustainable bridge location, will provide the optimum location for the control tower without the need for duplication and further development (of this type of infrastructure). It can also be argued that not having the control tower on the bridge adds to the low-lying sleek bridge aesthetics.

Proposed Mode of Operation of the Bascule Spans

The bascule spans will rotate about a pivot or trunnion located in the fixed spans north and south. Each bascule span is counterweighted by a short back span which allows the relatively short forward leaf to be balanced with a shorter heavier back span.

Both leaves will be operated using two hydraulic cylinders pinned to the counterweight and the fixed portion of the bridge. The span shall be balanced under permanent loads so that the cylinders are used to overcome inertial forces, friction and wind loads in the opening and opened positions.

The hydraulic cylinders are designed such that under all operating and holding conditions, the maximum static design pressure shall not exceed a certain lower pressure limit when two cylinders are operating or a higher pressure limit in the event that only one cylinder is operating.

The hydraulic system shall meet the requirements of "The American Association of State and Highway Transportation Officials" (AASHTO) for movable bridges in addition to any Irish National Annexes to Eurocodes.

The hydraulic power unit (HPU) pump capacity shall be sized such that the span can be opened or closed in no more than a specified value which shall be agreed with WCCC and the Port of Waterford, (typically of the order of 120 – 150 seconds) including acceleration and deceleration periods at the beginning and end of travel.

The HPU shall normally run using a minimum of two motor and pump units to provide the necessary flow with provisions to run the system from one pump unit only if necessary, for maintenance purposes. It is intended that a reservoir shall be provided with sufficient volume to equal at least twice the total rated pump flow in litres per minute or sufficient volume to store the complete volume of oil contained in the two cylinders, whichever is greater.

Span locks shall be required to lock the two forward leaf spans together when the bridge is in the closed position. These are designed as shear connections and therefore are designed to resist all applied live loads and to prevent opening of the span inadvertently using the hydraulic cylinders. A minimum of two span locks shall be required consisting of guided lock bars driven into receiver sockets on the adjoining span. The lock bars can be actuated using either electro-mechanical devices or hydraulic cylinders. In either case the actuators themselves shall not resist any live load once the lock bars are engaged and pedestrians, cyclists and the electric bus are allowed on the bridge.

It is not intended to provide tail locks, however a mechanism for holding the bridge in the open position, should this be required without using the hydraulic cylinders, will be incorporated between the fixed and moveable span.

The control system shall be designed to interlock all the various components such that it will not be possible for the operator to open or close the bridge out of proper sequence. The hydraulic cylinders shall have the capability of being controlled using an open or closed loop system with position feedback. This system shall work with either cylinder operating or both. During operation, the system shall always monitor position and pressure as well as temperature and incorporate sufficient alarms and shut-downs to prevent damage to the hydraulic system in the event of a malfunction.

<u>Location of Operating and Control Mechanisms</u>

As mentioned, the existing control tower on Rice Bridge is proposed as the "operator house" for the sustainable transport bridge. This will be accommodated as follows:

- An additional operating panel can be included in the control tower of Rice Bridge;
- The communications link between Rice Bridge control tower and the sustainable transport bridge can be either hard-wired or wireless;
- For the hard-wired option, a network switch would be located for the new control system in both plant rooms on the north and south quays. From these network switches, a new fibre optic cable through new or existing ducts will be installed and connected to the Rice Bridge control system;
- For the wireless option, the sustainable transport bridge can have a programmable logic controller (PLC) provided for each bascule span that will

minimise the data that needs to be transferred over the network which avoids any potential bandwidth issues that may occur with network sharing. In addition, a direct line of sight communication back-up between both bascule leaves (of the sustainable transport bridge) and Rice Bridge control house can be employed should hard wire communications fail or vice versa; and

- Independent power feeds will be provided for each bascule span and either a standby generator can be provided for each span or the provision of a generator plug on each side can be provided with a portable standby generator that can be connected to either bascule leaf on either side in the event of a failure.

Plant Room / Buildings

Two plant rooms will be required within the vicinity of the north abutment and the south abutment to house the plant and machinery used to operate the twin leaf bascule, whilst noting that the operating room will be in the control tower of the existing Rice Bridge. The plant rooms / buildings for each of the north and south bascules will provide for the following equipment; Hydraulic power unit, generator, standby generator drive and PLC units.

The span operating machinery, with the obvious exception of the hydraulic cylinders, will be located within the plant room on the north and south quays. However, consideration will also be given to housing the HPUs within the deck section in the vicinity of the central piers adjacent to the movable span.

This machinery will primarily consist of piping arriving (from the hydraulic cylinders on the bridge deck) to a HPU located within the plant room. The electric pump motors and valves for the HPU will be controlled from the electrical control room and operated from the operator station. Maintenance provisions must include a method to replace the hydraulic cylinders and HPU valves, motors and pumps without excessive effort or expense. These maintenance provisions are easily incorporated into the proposed plant rooms and buildings. The HPU shall be manufactured using corrosion resistant components and properly protected from corrosion for long life in the anticipated environment. The electrical controls shall be located inside a room protected from the outside environment which includes proper ventilation and heat if necessary.

The plant room / buildings which will be located on the north and south quays will be of the order of 5m x 10m plan area as presented in Figures 4.6 and 4.12 of Volume 3 of this EIAR. The final finishes of the building will be agreed with WCCC's Architects Department. It is intended that:

- For the north quays, the plant room will be located in a room(s) located within the proposed future developments for the north quays. Liaisons at the planning, detailed design and construction stage for any future development at the north quays will be required to determine the optimum location of the plant room;
- For the north quays, in the event that the sustainable transport bridge is required to open prior to any SDZ development on the north quays, a standalone building similar to that provided on the south quays will be required. This building will be developed in such a manner that it can be incorporated into any future development on the north quays or alternatively a temporary building would be erected to enable the bridge to open until such time as the permanent plant room within the SDZ development was constructed.
- For the south quays, a separate stand-alone building is proposed as illustrated in Figures 4.6 and 4.12 of Volume 3 of this EIAR. The location of this separate stand-alone building is the footprint of a possible future building on the western side of the south plaza. It is the intention that, should a building be developed at

this location in the future, the plant room(s) would be contained within this future development.

Electricity Power Supply and Distribution

The span operating machinery and pumps will be powered by three phase industrial duty electric motors. A substation will be required if ordinary industrial three phase power is not available close to the bridge on both quays in order to step the high transmission voltage down to medium and low voltage. The stepped down industrial voltage power will be used to directly power the hydraulic cylinders pump motors and any electro-mechanical devices such as span locks through motor starters and/or electronic controllers. The voltage will further be stepped down using additional transformers to provide single phase power used for lighting, control and for other uses.

Communications Systems

Topically, the bridge operator will have a normal phone line available for communication as well as an intercom system to communicate between the operator control room and other areas where maintenance personnel may be located such as the plant room / building where the hydraulic power unit is located. The regular phone line can be used to communicate with emergency personnel as well as marine personnel who can call in to request a bridge opening. In some cases, a loud speaker is provided allowing the operator to give instructions to pedestrians, cyclists and the electric bus users. CCTV cameras are also used on many bridges to allow the operator to see all areas of access to the moveable span. It is also intended that the control room may also have direct connection with the emergency service providers in Waterford.

Vessel Collision Protection

The AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges was used to determine the most appropriate bridge protection system. The design of a vessel protection system is particularly important given the light nature of this opening sustainable transportation bridge. Bridges with opening spans are particularly susceptible to interrupted service as a result of vessel collision, as even a minor collision event on the substructure or superstructure could cause failure of its electrical or hydraulic equipment. Regarding this, the proposed vessel collision protection system shall be completed independent of the bridge itself. The design of the protection system will ensure that there is no contact of the vessel with the sustainable transport bridge substructure or superstructure when the protection system is in the fully deformed position and the vessel has fully stopped. See the vessel collision protection system presented in Figures 4.2, 4.4 and 4.5 of Volume 3 of this EIAR.

In addition to the main protection system to the main piers, secondary vessel collision protection systems will be required at the intermediate pier locations. The design ship impact effects at these locations can be reduced based on the lower probability of occurrence due to the greater distance from the navigational channel.

The bridge navigational span will be provided with a fender protection system, which prevents vessels from laterally contacting with the bridge deck while the vessel is transiting through.

The protection system will be primarily made of steel piles with concrete infill, embedded into rock beneath the river bed. Three no. 1200mm diameter piles will be installed close to each other in proximity of the central pier and 2 no. piles in proximity of the intermediate piers. Because of the reduced probability of collision further from the centre of the navigational channel, a larger number of piles is provided in front of the two central piers. The collision protection system will also be designed in order to reduce their visual impact.

In addition, a system of smaller fenders will be installed to provide a visual guide to the ships passing through the bridge.

Bridge Approaches

<u>South Plaza</u>

The South Plaza is the entrance to the Sustainable Transport Bridge and consists of the following elements:

- Rearrangement of traffic lanes, cycle lanes, bus parking provisions and set down areas on Meagher's Quay and Coal Quay;
- At the end of Barronstrand Street, the footpaths and edge of carriageways levels shall be maintained. The existing hard surfacing including stone paving shall be maintained;
- Pedestrian crossings from Barronstrand Street to the South Plaza which will incorporate hard surfacing consisting of small size stone paving suitable for traffic. These pedestrian crossings shall have similar plan geometry to that of the bridge;
- The design of the footpaths, pedestrian crossings, cycle facilities will ensure a seamless priority of these transportation modes from the bridge, across the south plaza to Barronstrand Street, whilst also allowing existing traffic flows on the south quays;
- The Clock Tower is retained as a central and integral design focus of the South Plaza with its foundation surrounded in a semi-circular array of steps;
- Traffic bollards (demountable) will be provided to restrict vehicular traffic from entering the South Plaza or the Sustainable Transport Bridge;
- The central portion of the South Plaza leads to the sustainable transport bridge entrance and consists of hard surfacing small size stone paving suitable for light traffic, i.e., the electric bus. This area is also where the electric bus will depart and arrive and turn to bring pedestrians from the south quays to the north quays and vice versa;
- There is a transition point between the hard landscaping small stone paving to the bridge surfacing at approximately three quarters distance from the quays to the start of the sustainable transport bridge;
- To the east and west of the "central splayed zone" leading from Barronstrand Street to the bridge are areas of hard landscaping that will be constructed as part of the scheme. This will consist of the following: -
    - Large size stone paving and steps to accommodate the level differences between these level areas and the transitions from the bridge to Barronstrand Street;
    - Large size paving stone suitable for pedestrians which will incorporate public realm areas including seating and public lighting;
    - It is envisaged that there will be two buildings located in the zones indicated on Figure 4.6 of Volume 3 of this EIAR. The provision of these two buildings will be the subject of a future planning application, however, the provision of the foundations (as part of the foundation design for the South Plaza, as detailed in Chapter 8) is included and assessed in this EIAR. It is also

proposed to connect utilities (water, wastewater, electricity, communications etc.) to both buildings.

  - The plant room for some of the machinery, as discussed in the preceding sections, required to open the southern bascule leaf will be located in a small building which will be located on the proposed footprint of the future building (west side of plaza).

- Further to the east and west of the two foundations for future buildings, it is proposed to have two grassed and landscaped areas which will complete the proposed South Plaza.
- As the levels for the South Plaza gently rise from the Clock Tower to the south abutment, the existing flood defences will be removed, and new flood defences will be installed. The flood defences will terminate at the intersection with the bridge parapets, noting that the top of deck level at this point is at approximately +4.20m OD. There is an opportunity to emphasise this intersection noting the end of the flood defence wall and the commencement of the bridge parapets with an aesthetic feature which symbolises the start of the bridge.

All proposed details of the South Plaza shall be approved by WCCC's Architect's department.

Northern Approach

The northern approach and tie in of the sustainable transport bridge with the North Quays SDZ site is equally important. Unlike the south plaza, the north plaza is not included in this EIAR. However, in preparing the design of the bridge northern end, similar principles of design have been adopted to tie in with a future north plaza, similar to that of the proposed South Plaza. This North Plaza will be designed by others at a future date. However, it should be noted that the planning requirements which are stipulated in the approved Waterford North Quays SDZ, Planning Scheme 2018 state:

> *"PPS 33: Develop a high quality public realm through the provision of appropriate public space, surface treatments, street lighting, furniture and public art that promotes the North Quays as a modern innovative urban quarter whilst respecting its rich historical past and cultural heritage".*

The strict application of the above policies of the SDZ Planning Scheme will provide for an equally high quality urban and public realm design for the North Plaza as that of the South Plaza.

4.4 Lighting

A durable, energy-efficient illumination solution which provides a safe and well-lit environment for pedestrians, cyclists and the electric shuttle bus users has been developed for the bridge and South Plaza conforming to the requirements of British Standard (BS) 5489: Part 6. It will be ensured that no lighting is focused onto areas of ecological sensitivity including onto the River Suir and that lighting design provides for low levels of lateral light spillage to avoid unwanted areas of illumination.

Integrated rail lighting units are proposed along the bridge which will have high vandal resistance (in accordance with European standard EN62262) and will be finished in stainless steel, which offers exceptional corrosion resistance in a marine environment. In addition, architectural lighting and in-ground up-lighters are proposed at the bridge approaches and South Plaza to complete the lighting solution. All lighting aspects of the bridge will be controlled via a photocell arrangement that offers simplicity in day-to-day management. The final lighting units, beams, colours, dimming protocols etc. will be finalised in consultation with and approval of WCCC's architect's department.

4.5 Utilities

The underground and overhead utilities were mapped at the River Suir Sustainable Transport Bridge and South Plaza using services record data followed up with site reconnaissance. The following utility providers were contacted to request services records:

- Gas Networks Ireland;
- ESB (Electricity Supply Board);
- Irish Water;
- Virgin Media;
- EIR;
- Local Authority (Public Lighting, Stormwater, Drainage and Traffic); and
- Telecoms/ Cable TV/ Broadband: EIR, Vodafone, Aurora Telecom, BT, Centrecom, Three Ireland, ENET, Virgin Media, ESB Telecoms.

Responses were received from all providers with the exception of Aurora Telecom and Three Ireland. Centrecom, ESB Telecoms and Vodafone fixed apparatus have confirmed that they do not have any services in the area.

No overhead services are present. The following services have been identified at the River Suir Sustainable Transport Bridge landing area on the South Quays and location of the proposed South Plaza:

- Gas Network Ireland services;
- ESB Medium Voltage (MV)/ Low Voltage (LV), lighting, underground;
- Irish Water watermains;
- Local Authority (Sewer mains, traffic cables, public lighting); and
- Telecom/ Cable TV/ Broadband (BT, EIR, ENET and& Virgin Media).

In addition, there have been some unidentified services as noted on the underground utilities drawing. Information obtained from the 2007 report "*Waterford City Centre Pedestrian Bridge – Design Options Report – October 2007*" highlights that a number of services exist at the South Quay landing area, namely Bord Gais, Eircom and ESB network services.

The public lighting, power and other services listed in Table 4.2 will require diversion as part of the Sustainable Transport Bridge and South Plaza works. There are no envisaged service diversions for the north quays.

Table 4.2 Existing Services Impacted by the Bridge and South Plaza

North Quays
Watermains
South Quays
Rising Main (protection required)
Storm Water (local carpark)

ESB Underground
Telecom Underground (ESB)
Public Lighting Underground
Bord Gais
Traffic Light Underground
Unidentified Underground Services have also been picked up by GPR survey

Future Services Provision

Two service troughs will be detailed along the length of the bridge. These are required to provide services to the mechanical and electrical equipment that are housed in the bridge deck to facilitate the opening of the bridge.

However, in the unlikely event that the river is closed to larger vessel traffic at a future date and therefore no longer requires an opening span, the ends of the opening span bascule sections can be permanently closed and a continuous trough for services over the completed length of the bridge can be provided. The bridge abutment structure will provide suitable openings in the ballast wall in line with the bridge deck trough to allow services to pass through the abutment walls to the plant rooms and buildings located on the north and south quays.

4.6 Drainage

As private vehicles (cars, trucks, vans etc.) will not be permitted on the proposed bridge, the risk of surface water contamination is minimal. Surface water runoff from the bridge will not be permitted to drain freely from the bridge to the River Suir but will be collected in a closed system and will drain into existing surface water networks on the North Quays and the South Quays.

The bridge falls from the North Quay side to a lower level at the South Quay side, however as the bridge will have a lifting mechanism at central span, it will be necessary to drain both approach sections to the central span of the bridge separately and provide a drainage tie in connection at both the North and South Quay sides. On the bridge surface, water run-off will be collected in bridge deck drainage units and pipes (where necessary) which will be collected and fed into the surface water drainage network. The bridge and approach splay structures have been provided with a variable longitudinal profile ranging from 0% (no fall) on the north side to 3.4% on the south side, and a cross fall of 1.5% either side of the bridge centreline.

On the north quays, a closed system connection from the bridge and the plaza area will be provided which will tie into the future SDZ's drainage network.

On the south quays and South Plaza, runoff from the bridge and the new raised plaza areas will be collected and attenuated and will connect to the existing storm water network which then discharges to a combined sewer running from west to east along the R680 Meagher's Quay.

4.7 Landscaping and Furniture

Figure 4.5 of Volume 3 of this EIAR presents the proposed surfacing and furniture along the proposed bridge. Approximately 8 benches will be located along the bridge, grouped in pairs. They will be placed between pedestrian lanes and the shared space for cyclists and the electric shuttle bus. Benches with shelters will also be placed at the two locally widened sections of the bridge where users can rest at the lookout areas. The shelters will separate the lookout sections from the pedestrian, cycle and electric bus lanes and will also protect users from the wind. Planter boxes will be placed between benches to add to the aesthetics of the space.

Two landscaped areas will be provided on the South Plaza as shown in Figure 4.6 of Volume 3 of this EIAR. The plants and trees selected will be native and appropriate to the urban and riverine location. The landscaping plan and all associated furniture will be subject to the approval of the WCCC Architects Department and Heritage Officer.

4.8 Proposed Bus

The proposed courtesy bus will travel over and back across the proposed bridge, from the north quay landing point to the South Quay Plaza. The electric bus will be wheelchair accessible, will accommodate approximately 12-15 passengers and will have a range of 80km at full capacity. The vehicle will be approximately 5m in length, 1.5m in width and 2m in height and will have a turning radius of approximately 5.5m. The turning movement of the electric vehicle at the South Plaza is presented in Figure 4.6 in Volume 3 of this EIAR. An image of a similar bus is presented in Plate 4.3.

Plate 4.3 Similar Bus to that Proposed

4.9 Construction Methodology

4.9.1 Potential Construction Procurement Method

It is envisaged that the construction of the proposed development will be tendered under a Public Works Contract for Civil Engineering Works Designed by the Employer.

The advantage of the Employer Designed Works contract is that the design team who have undertaken the design and environmental assessment continue with the detailed design and site supervision, ensuring a continuity of knowledge through the remaining phases of the project through to completion and handover.

4.9.2 Timescale for Construction

It is expected that the construction of the proposed development will be progressed as a single construction contract with the construction phase potentially lasting approximately 18 to 24 months. If the North Quays SDZ is at construction stage at the time of the construction of the sustainable transport bridge, the bridge will not open until the North Quay development is in operation. If the North Quay development has not begun construction or is constructed at the time of the sustainable transport bridge completion, the bridge could be made operable once constructed.

4.9.3 Construction Arrangements

4.9.3.1 Site Compounds

Temporary construction compound sites will be required in the vicinity of the development. Any changes to the location or size of the proposed site compound must comply with all requirements stated within this EIAR and must have approval from WCCC. For the purpose of the EIA, the following areas have been assessed as potential locations of site compounds:

(i) South Quay - The site compound is envisaged to be located on the South Quay, to the west and east of the Clock Tower, where the contractor can have a direct access to the site. This area is envisaged to be approximately 4,540m^2; and

(ii) North Quay - No site compounds are envisaged to be permitted here in order to avoid interferences with the construction works of the proposed North Quay development.

The proposed main site compound on the South Quay, as presented in Figure 4.7 of Volume 3 of this EIAR, will include offices, materials storage areas, plant storage and parking for site and staff vehicles. The site is likely to remain in place for the duration of the contract but may be scaled up or down during particular activities on site. The compound(s) may be used either in full, in part, not at all, or another location could be selected, in agreement with the client subject to compliance with all environmental, planning and legal requirements. It is also envisaged that raw material, particularly steel bridge sections (as defined in the indicative construction sequences as presented in Figures 4.8 to 4.11 in Volume 3 of this EIAR) for bridge construction will be moved by barges along the River Suir to the site.

The construction compound(s) shall incorporate the protection and mitigation measures outlined in this EIAR and shall conform to the requirements outlined in the Outline Construction Environmental Management Plan (CEMP), Natura Impact Statement (NIS) and planning conditions. In particular this shall include avoidance of excessive lighting and in particular light spill onto the river. Lighting within 10m from the River Suir will be turned off outside normal working hours.

The contractor will be required to erect opaque hoarding of a minimum 2.0m in height around the site compound and works area on the South Quays. The hoarding shall be a high gloss printed finish with information and graphics about the project or as otherwise agreed with WCCC. The precise hoarding type shall be agreed with WCCC prior to works commencing.

Following completion of construction, the selected site compound area will be cleared and incorporated into the landscaped plaza.

4.9.3.2 Construction Sequence

The indicative construction sequence and construction methodology is outlined in Figures 4.8 to 4.11 of Volume 3 of this EIAR.

<u>Stage 1 – Site Setup and Clearance</u>

i. Construction compound/ site setup on the south quay to facilitate the bridge and south plaza construction;

ii. Implementation of measures to protect against accidental damage to the Clock Tower (RPS No. 392) and memorial statue during the works (refer to Figure 4.7 of Volume 3 of this EIAR);

iii. Site clearance of the Clock Tower car park, paved pedestrian areas / R680 road (street furniture, minor buildings, trees etc) over the extents of the south plaza works site as required (refer to Figure 4.6 of Volume 3 of this EIAR for south quay plaza site extents);

iv. Implementation of traffic management at the site and as required on the south quays and approaches;

v. Diversion of utilities affected by the works on the south quays including the relocation of the ESB substation located on the south plaza site; and

vi. Removal of the required sections of the existing floating jetty (deck and ramp) and removal of required existing jetty piles at the bridge location (refer to Figure 4.6 of Volume 3 of this EIAR for extents).

<u>Stage 2 – Complete South Quays Excavation and Piling</u>

i. Construction of permanent and temporary sheet piling in the river for the south abutment; and

ii. Installation of temporary flood protection measures.

<u>Stage 3 – Installation of Cofferdams and Temporary/Permanent Piles</u>

i. Completion of north abutment piling and construction of piled abutment;

ii. Construction of temporary works braced sheet pile cofferdams from jack-up pontoon or barge to allow for construction of the 2 number main span piers;

iii. Dewatering of cofferdam to allow installation driven steel tubes and concrete rocket sockets within the confines of the cofferdams using a crane mounted drilling rig operating from the jack-up barge/pontoon;

iv. Installation of vertical steel driven tubes and concrete rock sockets for intermediate pier locations from a crane mounted piling rig on jack-up barge/pontoon. Steel tubes to extend above high water level;

v. Construction of piles for four number temporary supports to support the two number central deck sections at both ends during construction;

vi. Construction of temporary working platforms within cofferdams to allow pilecap construction;

vii. The simultaneous presence of four number cofferdams in the river represents the worst-case scenario in terms of construction impacts on the river; and

viii. As noted in Figures 4.8 to 4.11 of Volume 3 of this EIAR, it is proposed to construct the bridge temporary works within the river and the bridge foundations in two halves. The first half of the bridge which could either be the southern or northern half will be commenced in June. The second half of the bridge will be commenced in November.

<u>Stage 4 –Reinforced Concrete Pier and Temporary Works Construction</u>

i. Cutting down of steel casings and concrete piles to underside of each pilecap level;

ii. Construction of main pier in-situ pilecaps and vertical squat piers;

iii. Construction of in-situ pilecaps and pier walls;

iv. Construction of temporary support concrete pilecaps above waterline; and

v. Construction of north and south abutments.

Stage 5 – Land Central Deck Sections

i. Using crane located on pontoon/barge, lifting of each 50m long central section of deck (comprising of the V-shaped steel struts) onto the supporting jacking points located on the temporary supports and piers; and

ii. Construction of in-situ connection between steel struts and concrete piers.

Stage 6 – Land End and Opening Spans

i. Landing end spans on abutment and intermediate piers;

ii. Completion of end span deck site splice connection to central deck sections; and

iii. Making intermediate concrete pier/steel deck integral connection and installation of the abutment permanent bearings.

Stage 7 – Installation of deck opening sections

i. Installation of two deck opening sections to complete the bridge; and

ii. Installation of lifting mechanism machinery and counterweight. Testing and commissioning.

Stage 8 – Complete Deck Approaches and Finishes

i. Removal of temporary works cofferdams, frames and supports;

ii. Installation of driven piles as part of vessel collision protection system and fenders;

iii. Construction of bridge south approach ramp/steps and reinstatement of glass panel flood wall sections to tie into bridge abutment wall;

iv. Completion of bridge finishes – local painting at connections, parapets and glass wind shielding, handrail lighting and feature lighting, deck plate combined waterproofing and surfacing, lifting spans pedestrian barriers and abutment end movement joints; and

v. Completion of south plaza approach area.

4.9.3.3 Construction Material

Exposed concrete elements will have smooth and uniform texture and appearance using a suitable proprietary formwork liner system.

C50/60 concrete (i.e. cylindrical strength of 50 N/mm^2 and cube strength of 60 N/mm^2) is proposed for all substructure elements with the exception of the piles (C40/50). The pilecap/pier concrete will include a minimum of 50% ground granulated blast furnace slag (GGBS) cement replacement which will increase durability in a marine environment. Durability requirements are shown in Table 4.2 for the various concrete elements.

Reinforcement shall be carbon steel high yield and comply with Irish Standard I.S. EN 10080:2005 and British Standard BS 4449:2005 (Grade B500B) in the bridge piles, pilecaps and south abutment structure.

Stainless steel reinforcement (grade 1.4162 to EN 10088) or increased concrete strengths in combination with increased cover shall be used for the external layers of links and main reinforcement in the pier elements (tidal river and splash zones) and north and south abutments. In the event carbon steel reinforcement is fixed to stainless steel reinforcement within the piers, a minimum of 120mm (100+Δc) cover shall be provided to the carbon steel reinforcement. No additional separation measures are proposed.

Stainless steel reinforcement (or equivalent durability measures) will also be used in the parapet edge beam elements of the south bridge approach structure which may be exposed to de-icing salts used on the deck/plaza/approach ramp areas.

Table 4.2 Durability Requirements for Concrete Elements

Element	Governing Exposure Class	Cover *C_{nom}	Grade
Piles	(cased in steel)	75	40/50
Pilecaps	XS2	60	50/60
Piers and North Abutment	XS3	60	50/60
South Abutment	XS1	50	40/50

*C_{nom} is the nominal cover

Structural Steelwork Grades and Finishes

Surface preparation and protection against corrosion shall be provided in accordance with the Transport Infrastructure Ireland (TII) Design Manual for Roads and Bridges (DMRB). The intended protection system for structural steel will be a glass flake system which provides a long term corrosion protection to the steel structure in accordance with the TII Specification for Roadworks.

Steel plates will be steel a minimum of grade S355 to European Standard EN 10025.

4.9.3.4 Set up of Construction Compound and Traffic Management

The operations associated with the establishment of the site compound(s) will be subject to the agreement on a site Construction and Demolition Waste Management Plan (CDWMP) prior to commencement of site activity. All traffic management activities will be subject to the requirements of Chapter 8 of the Traffic Signs Manual published by the Department of Transport, the approval of WCCC, and the Garda Síochána, and any licensing and permits necessary under current legislation.

Any potential for impacts to deliveries to businesses along the South Quay will be mitigated against through co-ordination between WCCC and the business operators.

4.9.4 Enabling Works and Site Access

4.9.4.1 Site Access Routes

The haulage of materials to and from the site will create an adverse temporary impact to both road users, business owners and to residents living along haul roads. To minimise these impacts it is important that only authorised site access roads, as directed by the Local Authority, are used by construction vehicles.

It is proposed that access to the site for the works will be primarily off national roads and along the following regional roads:

- R448 Newrath/ Rice Bridge;
- R711 Dock Road;
- R680 South Quays; and
- R710 Ring Road.

4.9.4.2 Construction Traffic Routing

There are no bridges downstream of the proposed development which would represent a constraint on access by water. Access to the site is likely to be both by road and by the River Suir. The bridge segments are likely to be transported along the River Suir. The roundabouts along the South Quay will limit the practicable size of elements to be transported to site via road. Site based assembly of steelwork is therefore likely to be necessary and a transportation of deck splices is envisaged to be performed by barge.

4.9.4.3 Safety Measures on the River for Navigation

4.9.4.4 Working Hours

Normal working hours will be employed during the construction phase as follows:

- Monday to Friday 07:00 to 19:00hrs
- Saturday 08:00 to 16:30hrs
- Sunday and Bank Holidays 08:00 to 16:30hrs

Works on Sundays and Bank Holidays will only be permitted with the approval of the Client. Similarly, emergency works outside of the normal working hours will only be permitted with the approval of the planning authority.

The permitted working hours for piling in the SAC as agreed with the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI) is as follows:-

- Monday to Friday 08:00 to 18:00hrs
- Saturday Not allowed
- Sunday Not allowed

4.10 Environmental Management Plans

The following outline draft Environmental Management Plans which will be used by the Contractor to develop the Construction Stage Environmental Management Plans are outlined below and contained within Appendix 4.1a to 4.1c.

4.10.1 Environmental Operating Plan

The EOP is a document that outlines procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that can arise during the construction phase of developments. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractor during the project construction stage and will be limited to setting out the detailed procedures by which the mitigation measures proposed as part of the EIAR and NIS and arising out of the Board's decision (if approving the proposed development) will be achieved. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment.

Before any works commence on site, the Contractor will be required to prepare an EOP in accordance with the TII/National Roads Authority (NRA) *Guidelines for the Creation and Maintenance of an Environmental Operating Plan*. The EOP will set out the Contractor's approach to managing environmental issues associated with the construction of the scheme and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include:

- All environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the NPWS and IFI as well as a method documenting compliance with the measures;

- A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and
- Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment.

To oversee the implementation of the EOP, the Contractor will be required to appoint a suitably competent Site Environmental Manager (SEM) to ensure that the mitigation measures included in the EIAR, the EOP and the statutory approvals are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly. The EOP contains the Outline Incident Response Plan (IRP) which describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts are prompt, efficient, and appropriate to particular circumstances. It has been developed to provide the information that each employee may need in order to respond to an emergency and to handle it effectively. The Outline IRP contains a copy of WCCC's Major Emergency Plan.

4.10.2 Construction Environmental Management Plan

Prior to any demolition, excavation or construction, a Construction Environmental Management Plan (CEMP) will be produced by the successful contractor. The CEMP will set out the Contractor's overall management and administration of the construction project. The CEMP will be prepared by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the outline CEMP, Environmental Operating Plan (EOP) and the CDWMP. The Contractor will be required to include details under the following headings:

- Details of working hours and days;
- Details of emergency plan - in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services;
- Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages);
- Details of construction plant storage, temporary offices;
- Traffic management plan (to be developed in conjunction with the WCCC Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat runoff);
- Dust management to prevent nuisance (demolition and construction);
- Site run-off management;
- Noise and vibration management to prevent nuisance (demolition and construction);
- Landscape management;
- Management of demolition of all structures and assessment of risks for same;
- Stockpiles;
- Project procedures and method statements for;

    - Demolition and removal of buildings, services, pipelines (including risk assessment and disposal);
    - Diversion of services;
    - Excavation and blasting (through peat, soils and bedrock);
    - Piling;
    - Construction of pipelines;
    - Temporary hoarding and lighting;
    - Borrow pits and location of crushing plant;
    - Storage and treatment of peat and soft soils;
    - Disposal of surplus geological material (peat, soils, rock etc.);
    - Earthworks material improvement; and
    - Protection of watercourses from contamination and silting during construction;
- Site Compounds.

The production of the CEMP will also detail areas of concern with regards to health and safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.

4.10.3 Construction and Demolition Waste Management Plan (CDWMP)

The CDWMP will be included within the CEMP, clearly setting out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline CDWMP has been prepared for the proposed development. The outline CDWMP is a live document that will be amended and updated to reflect current conditions on site as the project progresses. The obligation to develop, maintain and operate a CDWMP will form part of the contract documents for the project. The plan itself will contain, but not be limited to, the following measures:

- Details of waste storage to be provided for different waste;
- Details of where and how materials are to be disposed of - landfill or other appropriately licensed waste management facility;
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of where necessary; and
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner.

Appendix 4.1
Outline Environmental Operating Plan

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

River Suir Sustainable Transport Bridge

Outline Environmental Operating Plan

December 2018

Client
Waterford City and County Council
The Mall
Waterford

Consulting Engineer
Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18, D18 V8P6

River Suir Sustainable Transport Bridge

Outline Environmental Operating Plan

TABLE OF CONTENTS

1.0 INTRODUCTION

This document is a project-specific outline Environmental Operating Plan (EOP). It is presented to inform and provide practical experience of developing, submitting and maintaining an EOP for the construction and operation of the River Suir Sustainable Transport Bridge.

1.1 Purpose and Scope

This outline EOP sets out the mechanism by which environmental protection is to be achieved on the River Suir Sustainable Transport Bridge. This EOP describes the Environmental Management System (EMS) of the proposed development, which will be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems and developed in line with the NRA (now known for operating purposes as Transport Infrastructure Ireland (TII)) *"Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan".* This EOP will be complemented by General Procedures, Work Procedures and Operations Instructions. These documents will be in place within the site administration offices and appropriate site locations during works.

This outline EOP covers the activities of the [*Successful Contractor Name*] and that of its sub-contractors. It outlines the environmental commitments in relation to the construction works and how these commitments are to be managed, including details of the monitoring systems and mitigation measures to be employed by the successful contractor. It also assigns responsibilities for ensuring the effective implementation of this EOP.

1.2 Environmental Policy Statement

Environmental management is fundamental to the successful operation of construction activities. Therefore, the Environmental Policy must, as a priority, be understood by all parties involved in the contract and adhered to throughout the course of the works to allow for legal compliance and continuous improvement.

[*Successful Contractor Name*] Environmental Policy Statement is detailed below.

[*Insert policy statement*]

2.0 GENERAL PROJECT DETAILS

This section will be completed by the successful contractor once appointed:

- Brief overview;
- Location of the Project;
- Location of compounds;
- Contact Sheets for site, employer and third party contacts;
- Register of all applicable legislation, including relevant standards, Codes of Practice and Guidelines;
- Organisational chart; and,
- Duties and responsibilities.

Project details which have been identified prior to appointment of the contractor are described in the subsequent subsections.

2.1 Concrete Works

2.1.1 Introduction

The use and management of concrete in or close to watercourses must be carefully controlled to avoid spillage which has a deleterious effect on water chemistry and aquatic habitats and species. Alternate construction methods have been proposed where possible, e.g. use of pre-cast units, use of cofferdams to place concrete in the dry, and permanent formwork will reduce the risks associated with concreting works. Where the use of insitu concrete near and in watercourses cannot be avoided the following control measures will be employed:

- When working in or near the surface water and the application of in-situ materials cannot be avoided, the use of alternative materials such as biodegradable shutter oils shall be used;
- Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near the River Suir;
- Placing of concrete in or near the River Suir will be carried out only under the supervision of a suitably qualified Environmental Manager;
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials. Such spills shall be contained immediately and runoff prevented from entering the River Suir;
- Concrete waste and wash-down water will be contained and managed on site to prevent pollution of the River Suir;
- On-site concrete batching and mixing activities will only be allowed at the identified construction compound;
- Washout from concrete lorries, with the exception of the chute, will not be permitted on site and will only take place at the construction compound (or other appropriate facility designated by the supplier);
- Chute washout will be carried out at designated locations only. These locations will be signposted. The Concrete Plant and all Delivery Drivers will be informed of their location with the order information and on arrival on site; and,
- Chute washout locations will be provided with appropriate designated, contained impermeable area and treatment facilities including adequately sized

settlement tanks. The clear water from the settlement tanks shall be pH corrected prior to discharge (which shall be by means of one of the construction stage settlement facilities) or alternatively disposed of as waste in accordance with the contractor's Waste Management Plan.

2.2 Construction Compounds

2.2.1 Introduction

It is likely that there will be a single site construction compound located on the South Quay, at the site of the bridge landing/South Quay Plaza, to service the bridge construction operations. However, these will be dependent on the appointed contractors.

The construction compound may include stores, offices, material processing areas, plant storage, parking of site and staff vehicles, and other ancillary facilities and activities.

During the construction phase, the contractor will be required to erect opaque hoarding of a minimum 2.0 metres in height around the site compound and works area on the South Quays. The hoarding shall be a high gloss printed finish with information and graphics about the project or as agreed with Waterford City and County Council. The precise hoarding type shall be agreed with Waterford City and County Council prior to works commencing.

2.2.2 Control Measures

The compound will have appropriate levels of security to deter vandalism, theft and unauthorised access.

Surface runoff from the compound will be minimised by ensuring that the paved/ impervious area is minimised. All surface water runoff will be intercepted and directed to appropriate treatment systems (settlement facilities and oil trap) for the removal of pollutants prior to discharge. The site compound will be fenced off and a silt fence erected and maintained on the site boundary.

Wastewater drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent water pollution and in accordance with the relevant statutory requirements.

The storage of all fuels, other hydrocarbons and other chemicals shall be within the construction compound only and shall be in accordance with relevant legislation and best practice. In particular:

- Fuel storage tanks shall have secondary containment provided by means of an above ground bund to capture any oil leakage;
- All hazardous materials will be stored within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase;
- Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction; and
- Storage tanks and associated provision, including bunds, will conform to the current best practice for oil storage and will be undertaken in accordance with *Best Practice Guide BPGCS005 – Oil Storage Guidelines* (Enterprise Ireland).

The Incident Response Plan (IRP) (an outline IRP is located in Appendix A of this EOP) shall include arrangements for dealing with accidental spillage and relevant staff shall be trained in these procedures.

Mitigation measures during the construction phase will include implementing best practice to avoid sediment entering the River Suir. Runoff will be controlled and treated to minimise impacts to surface water and groundwater, (refer to Chapters 9 and 10 in Volume 2 of this EIAR).

2.3 Site Environmental Manager (SEM)

In order to ensure the successful development, implementation and maintenance of the EOP, the Contractor will be required to appoint an independent Site Environmental Manager (SEM) to provide independently verifiable audit reports.

The SEM must possess sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken, a Level Eight qualification recognised by the Higher Education and Training Awards Council (HETAC), or a University equivalent, or other qualification acceptable to the Employer, in Environmental Science or Environmental Management, Environmental Hydrology, Engineering or other relevant qualification acceptable to the Employer. The SEM will demonstrate experience working in the protection of European Sites.

Separate from the on-going and detailed monitoring carried out by the contractor as part of the EOP; the SEM shall carry out the inspection/ monitoring regime described below, and report to the Contractor. The results will be stored in the SEM's monitoring file and will be available for inspection/ audit by the Client, National Parks and Wildlife Service (NPWS) or Inland Fisheries Ireland (IFI) staff. All inspections/ monitoring/ results will be recorded on standard forms.

(i) Control measures for works at or near the River Suir shall be inspected on a daily basis;

(ii) In-situ concrete operations at or near the River Suir shall be supervised and designated chute washing out facilities shall be inspected on a daily basis;

(iii) Site compounds shall be inspected on a weekly basis;

(iv) Vibration monitoring is recommended at the Clock Tower during piling and any demolition works required in order to ensure compliance with defined thresholds;

(v) Water quality monitoring will be undertaken at two monitoring locations in the River Suir on a monthly basis from 6 months prior to construction, on a weekly basis during construction and on a monthly basis for at least 24 months post-completion; and

(vi) Hydroacoustic monitoring will be undertaken for the full duration of the construction of the proposed development. The results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works.

2.4 Ecological Clerk of Works (ECoW)

In order to ensure the successful development and implementation of the EOP, the Contractor will appoint an independent Ecological Clerk of Works (ECoW). The ECoW must possess training, experience and knowledge appropriate to the role, including:

- An NFQ Level 8 qualification or equivalent or other acceptable qualification in ecology or environmental biology; and,

- Demonstrable experience in the protection of European sites.

The principal functions of the ECoW are:

- To provide ecological supervision of the construction of the proposed development and thereby ensure the full and proper implementation of all the mitigation measures relating to biodiversity prescribed in the EIAR and NIS;
- To regularly review the outcome of the specialist hydroacoustic monitoring and, on that basis, make any necessary adjustments to the mitigation; and,
- To carry out weekly inspections and reporting on the implementation of the Contractor's Biosecurity Protocol.

During the preparation of the Contractor's EOP, the SEM may, as appropriate, assign other duties and responsibilities to the ECoW.

In exercising his/her functions, the ECoW will be required to keep a monitoring file and this will be made available for inspection or audit by WCCC, the NPWS or IFI at any time.

3.0 PLANNING CONSENT

If planning permission is granted for the proposed development, the entire contents of the planning consent are inserted at this location.

[*Insert planning consent*]

4.0 SCHEDULE OF COMMITMENTS

The Schedule of Commitments comprises the mitigation measures as outlined in Chapter 18 Mitigation Measures of the Environmental Impact Assessment Report and any additional commitments arising during the EIA process up to and including the Oral Hearing.

The current Schedule of Commitments is as follows:

[*Insert Schedule of Commitments*]

In addition, the Contract documents, the conditions imposed by An Bord Pleanála, the Schedule of Commitments, and relevant environmental legislation all prescribe environmental performance criteria.

The following table lists the complete suite of Environmental Commitments together with the relative specification and evidence of how each commitment will be met. An example of the layout of this table and potential entries is given below.

Table 1 Environmental Commitments

Environmental Commitment	Legislation / Specific Ref.	Action Owner	Evidence	Target Date	Close Date
Noise and Vibration	EIAR Volume 2, Chapter 12 Noise and Vibration; EIAR Volume 2, Chapter 18 Mitigation Measures	Env. Manager / Noise Specialist / Env. Designer / Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data / Environmental Control Measure Sheet	Ongoing	End of contract
Biodiversity	EIAR Volume 2, Chapter 7 Biodiversity; EIAR Volume 2, Chapter 18 Mitigation Measures; Figures 7.1-7.2	Env. Manager/ specialist ecologist/ Env. Designer / Site Agent / Foreman	Method Statement / Ecological Walkover / Pre-surveys / agreement from IFI / Site Inspections	Ongoing	End of Contract

5.0 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

A Construction and Demolition Waste Management Plan (CDWMP) is prepared to ensure that waste arising during the construction and demolition phase of the development on site will be managed and disposed of in a way that ensures the provisions of the Waste Management (Amendment) Acts, 1996-2011 and associated Regulations (1996-2011) are complied with and to ensure that optimum levels of reduction, re-use and recycling are achieved.

An outline CDWMP, consistent with mitigation measures as contained within the EIAR and the Schedule of Commitments, at this time is contained in Appendix A of this EOP.

6.0 INCIDENT RESPONSE PLAN

This document describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts are prompt, efficient, and appropriate to particular circumstances.

An outline Incident Response Plan, consistent with mitigation measures as contained within the EIAR and the Schedule of Commitments, at this time is contained in Appendix B of this EOP.

APPENDIX A

Outline Incident Response Plan

River Suir Sustainable Transport Bridge

Outline Incident Response Plan

December 2018

Client
Waterford City and County Council
The Mall
Waterford

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River Suir Sustainable Transport Bridge

Outline Incident Response Plan

TABLE OF CONTENTS

1.0 INTRODUCTION

This Outline Incident Response Plan (IRP) describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts are prompt, efficient, and appropriate to particular circumstances. It has been developed to provide the information that each employee may need in order to respond to an emergency and to handle it effectively.

2.0 OBJECTIVE OF PLAN

The primary objective of this document is to:

- Ensure the health and safety of workers and visitors at and in proximity to the site;
- Minimise any impacts to the environment and to ensure protection of the water quality and the aquatic species dependant on it;
- Protect property and operations at the proposed site and to minimise the impact on the continuity of business; and,
- Establish procedures that enable personnel to respond to incidents with an integrated multi-departmental effort and in a manner that minimises the possibility of loss and reduces the potential for affecting health, property and the environment.

3.0 RESPONSIBILITY

It is the responsibility of the Site Environmental Manager to maintain and update this Outline IRP as required.

This Outline IRP will be reviewed on an ongoing basis and amended, as necessary, when one or more of the following occur:

- Applicable regulations are revised;
- The Plan fails in an emergency;
- The project changes in its design, construction, operation, maintenance, or other circumstance in a way that materially increases the potential for impacts on the environment, workers or visitors to the site; and/or,
- Amendments are required by a regulatory authority.

4.0 OTHER PLANS

Waterford City and County Council has a Major Emergency Plan prepared in accordance with the Government's Major Emergency Management Framework. This plan details the initial contact that should be made in the case of an emergency incident as well as those responsible for following up once an emergency event is declared. This plan will be available to the Contractor and may be referred to during both the construction and operation phases. The Plan is presented in Appendix A.

5.0 OUTLINE INCIDENT RESPONSE PLAN

Name and address of the Client:

Waterford City and County Council

The Mall, Waterford

The contact within the Client organisation is Mr Peter Keane (tel. 0761 10 2788).

Site Location:

The proposed development is located in Waterford City centre, from the Clock Tower on the South Quay to the North Quay (Appendix A Figure 1).

Overview of the activities on site:

The development comprises the following major elements:

- Construction of compound/ site setup on the south quay to facilitate the bridge and south plaza construction;
- Site clearance of the clock tower car park, paved pedestrian areas / R680 road over the extents of the south plaza works site;
- Diversion of utilities affected by the works on the south quays;
- Removal of the required sections of the existing floating jetty and existing jetty piles at the bridge location;
- Construction of permanent and temporary sheet piling in the river for the south abutment;
- Completion of north abutment piling and construction of piled abutment;
- Construction of north and south abutments;
- Construction of vessel collision protection system and fenders;
- Construction of bridge south approach ramp/steps; and
- Completion of south quay plaza approach area.

Description of the proposed development and surrounding area:

The proposed development comprises a sustainable transport bridge crossing the River Suir in Waterford City and a plaza on the South Quay. It is anticipated that the proposed bridge will provide a new pedestrian, cycle and courtesy electric bus link between the North Quays and South Quays, promoting the further development of Waterford City and facilitating the development of the North Quays Strategic Development Zone (SDZ) lands. The proposed development is termed a 'Sustainable Transport Bridge' due to the fact that it will support sustainable modes of transport including pedestrians, cyclists and electric bus users. The proposed bridge will span from the North Quays to the South Quays where it will land in the vicinity of the Clock Tower on Meagher's Quays. The bridge will be approximately 207m long and will extend the retail spine of Waterford City across to the North Quays SDZ and to Ferrybank and Belview. The north quays at present comprise an assembly of wharves consisting of disused open spaces following the demolition of the buildings along the north quays in 2016 and the Hennebique building in July 2018. The Rosslare to Waterford rail line terminates to the east of the north quay landing point. The south quay setting currently comprises an at-grade car park that is adjacent to Merchant's Quay (R680), a 19th century clock tower, a walkway along the river edge and a glass walled flood defence. A marina is also located parallel with the river at this point with access via the adjoining car park.

Potential Incidents:

Potential incidents requiring emergency response procedures include:

- Fuel and oil spills;
- Road traffic accidents involving chemical or biological spills;
- Earth slippages;
- Extreme rainfall events, causing flooding of the River Suir;
- Fires;
- Activities resulting in noise and vibration, air pollution, hazardous substances or impacts on water;

- Waste management; and,
- Discharge of effluent.

The Contractor will update the list of potential incidents based on their proposed construction methods and programme for the River Suir Sustainable Transport Bridge and include, as a minimum, the following:

- The measures to be taken to avoid or reduce the risk potential;
- Procedures to be put in place to deal with the risk;
- Person responsible for dealing with incidents;
- Procedures for alerting key staff;
- Standby/rota systems;
- Clearly defined roles and responsibilities;
- Names of staff and contractors trained in incident response;
- The types and location of emergency response equipment available and appropriate personal protective equipment to be worn;
- A system of response coordination;
- Off-site support; and,
- Particular emergency service or persons to be notified in case of incident.

Date and version of the plan:	**Name or position of person responsible for compiling/approving the plan:**
December 2018 V1	Christine Murphy and Barry Corrigan Roughan & O'Donovan
Review Date:	**Date of next exercise:**

Objectives of the IRP:

To ensure works are carried out in such a way as to avoid injury, health hazards or pollution incidents, however, should any such incident occur, procedures and measures will be implemented to contain, limit and mitigate the effects as far as reasonably practicable.

List of external organisations consulted in the preparation of the IRP:

TBC by Contractor when preparing IRP

Distribution of the IRP

Recipient	No. of copies	Version

6.0 EXTERNAL CONTACTS

Contact	Office Hours	Out of Hours
External Contacts		
Waterford City Fire Service	0761 10 2982	999 / 112
Gardaí: Emergency	999 / 112	999 / 112
Gardaí: Waterford Garda Station	(051) 305 300	(051) 305 300
Waterford University Hospital	(051) 848000	(051) 848000
EPA Regional Inspectorate Wexford	(053) 916 0600	-
Waterford City and County Council Emergency Planning Department	0761 10 20 20	0761 10 20 20
ESB	1850 372 757	1850 372 999

Contact	Office Hours	Out of Hours
Bord Gáis	1850 200 694 / 1850 20 50 50	1850 20 50 50
Waste Management Contractor	TBC	
Specialist Advice	TBC	
Specialist Clean up Contractor	TBC	
Waterford City and County Council	0761 10 20 20	-
Inland Fisheries Ireland		To be agreed with IFI
National Parks & Wildlife Service		To be agreed with NPWS

7.0 INTERNAL (CONTRACTORS) CONTACTS

Contact	Office Hours	Out of Hours
Internal Contacts		
Names and positions of staff authorised/trained to activate and coordinate the IRP	TBC	
Other Staff	TBC	
Managing Director	TBC	
Site Manager	TBC	
Health & Safety Manager	TBC	
Site Environmental Manager	TBC	

8.0 CHEMICAL PRODUCT AND WASTE INVENTORY

Inventory of Chemical Products and Wastes						
Trade Name / Substance	**Solid / liquid / gas or powder**	**UN number**	**Maximum amount**	**Location marked on site plan**	**Type of containment**	**Relevant health and environmental problems**

9.0 POLLUTION PREVENTION EQUIPMENT INVENTORY

Inventory of Pollution Prevention Equipment (on- and off-site resources)			

10.0 DRAWINGS

Drawings of the proposed road development are included in **Appendix A**.

Site Plan
Figure 1 - Location Plan

11.0 RESPONSE PLANNING

11.1 Incident Response Plan

The Contractor's Environmental Operating Plan (EOP) will include an Incident Response Plan, which will detail the controls to be adopted to manage the risk of pollution incidents and procedures to be followed in the event of any pollution incidents.

11.2 The Incident Response Plan will include the following, as appropriate:

- Reference to the Method Statements and Management Plans for other construction activities, insofar as they are relevant for the purposes of mitigating against health and safety and pollution incidents;
- Procedures to be adopted to contain, limit and mitigate any adverse effects, as far as reasonably practicable, in the event of a health and safety or pollution incident;
- Details of spill clean-up companies appropriate to deal with pollution incidents associated with the materials being used or stored on site.
- Procedures to be followed and appropriate information to be provided in the event of any incident, such as a spillage or release of a potentially hazardous material;
- Procedures for notifying appropriate emergency services, authorities, the Employer's Representative and personnel on the construction site;
- Procedures for notifying relevant statutory bodies, environmental regulatory bodies, local authorities and local water and sewer providers of pollution incidents, where required;
- Maps showing the locations, together with address and contact details, of local emergency services facilities such as police stations, fire authorities, medical facilities and other relevant authorities; and,
- Contact details for the persons responsible on the construction site and within the Contractor's organisation for pollution incident response.

11.3 Monitoring

The Contractor will investigate and provide reports on any health and safety or pollution incidents to the Employer's Representative, including, as appropriate:

- A description of the incident;
- Contributory causes;
- Adverse effects;
- Measures implemented to mitigate adverse effects; and,
- Effectiveness of measures implemented to prevent pollution.

The Contractor will undertake appropriate monitoring of the procedures and measures set out in the management plans for construction activities required to prevent health and safety or pollution incidents to ensure they are being adequately implemented.

The Contractor will monitor the effectiveness of the procedures and measures implemented in the event of an incident and the effectiveness of the response procedures set out in the Incident Response Plan to identify any areas where improvement is required.

APPENDIX A

Waterford City and County Council Major Emergency Plan

Comhairle Cathrach & Contae Phort Láirge
Waterford City & County Council

Waterford City & County Council

MAJOR EMERGENCY PLAN

2015

Title:	**Major Emergency Plan**
Version:	**1**
Date:	**March 2015**
Status:	**Approved**
Prepared By:	**Des Hoctor**
Approved By:	**WCCC Management Team**

Record of Issues and Amendments

Amendment No.	Version No.	Date	Section Amended	Amended By
1.				
2.				
3.				
4.				
5.				
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Contents

Section 1

Introduction to Plan

1.1 An introduction to Plan

A Major Emergency is any event which, usually with little or no warning, causes or threatens death or injury, serious disruption of essential services or damage to property, the environment or infrastructure beyond the normal capabilities of the principal emergency services in the area in which the event occurs, and requires the activation of specific additional procedures and the mobilisation of additional resources to ensure an effective, co-ordinated response.

1.2 Background

In 2006 the government approved a two-year Major Emergency Development Programme 2006-2008 (MEDP) to allow for the structured migration from current arrangements to an enhanced level of preparedness via the new emergency management process. The purpose of this plan is to put in place arrangements that will enable the three principal emergency response agencies, An Garda Síochána, the Health Service Executive and the Local Authorities to co-ordinate their efforts whenever a major emergency occurs.
The systems approach to Major Emergency Management involves a continuous cycle of activity. The principal elements of the systems approach are:

- Hazard Analysis/ Risk Assessment;
- Mitigation/ Risk Management;
- Planning and Preparedness;
- Co-ordinated Response; and
- Recovery.

Fig 1.1: Five Stage Emergency Management Paradigm

1.3 The objectives

The objective of this Plan is to protect life and property, to minimize disruption to the area, and to provide immediate support for those affected. To achieve this aim the Plan sets out the basis for a coordinated response to a major emergency and the different roles and functions to be performed by the various agencies. The fact that procedures have been specified in the Plan should not restrict the use of initiative or common-sense by individual officers in the light of prevailing circumstances in a particular emergency.

1.4 The scope of the Major Emergency Plan

The Scope of the Major Emergency Plan is such that the plan provides for a co-ordinated inter-agency response to major emergencies beyond the normal capabilities of the principal emergency services.

1.5 The relationship / inter-operability of the Major Emergency Plan with other emergency plans

An Garda Síochána, the Health Service Executive and Waterford City & County Council are the Principal Response Agencies (PRA) charged with managing the response to emergency situations which arise at a local level.
In certain circumstances, the local response to a major emergency may be scaled up to a regional level, activating the Plan for Regional Level Co-ordination. If this is so the principal response agencies are An Garda Síochána, the Health Service Executive and South East Region Local Authorities (Carlow, Wexford, Kilkenny & Waterford), members of which all sit on the Regional Steering Group.

1.6 The language / terminology of the Plan

In situations where different organisations are working together, there is a need for common vocabulary to enable them to communicate effectively. This is particularly the case where the principal emergency services and a range of other bodies are working together under the pressures that a major emergency brings. Therefore a full set of relevant terms and acronyms are provided in the *Appendices*, which should be used by **all** agencies.

1.7 The distribution of the Plan

Copies of the plan will be distributed to all departments of Waterford City & County Council appropriate Heads of Service, Emergency Planning Team members, and Emergency services. The distribution list is outlined *Appendices.*

Name / Organization

Waterford City & County Council

- Chief Executive Officer
- Director of services
- Senior Engineers
- Chief fire officer
- MEM 'Key role' holders

Other local Authorities

- Carlow
- Kilkenny
- Wexford
- Tipperary
- Cork

An Garda Síochána

- Waterford Division

Health Service Executive

Defence Forces

Volunteer Emergency Services

1.8 The status of the Plan and when and how it will be reviewed / updated

It will be reviewed and updated on an annual basis and also follow any exercises or incidents.

- Plan Implementation Date: March 2015
- Plan Review Date: March 2016

1.9 Public access to the Plan

An edited copy of the Emergency Management Plan, with contact telephone numbers and other personal information removed, will be available to the public on the Council website at www.waterfordcouncil.ie

Section 2

Waterford City & County Council and its Functional Area

2.1 Role of Waterford City & County Council

The functional area of this plan is the administrative area of Waterford City & County. In the event of a major emergency, the role of Waterford City & County Council is to ensure life safety by providing a top class emergency service in the form of the Fire Service and Civil Defence. Waterford City & County Council will ensure that danger areas are made safe in order to permit other agencies to undertake their recovery and rehabilitation operations. In the immediate aftermath of an incident principal concerns include support for the other emergency services, support and care for the local and wider community, use of resources to mitigate the effects of the emergency and co-ordination of the voluntary organisations. In the 'recovery' phase, the local authority will be responsible for leading and co-ordinating the rehabilitation of the community and the restoration of the environment.

2.2 Boundaries and characteristics of area.

Waterford City & County is located in the South-East Region of Ireland. Waterford City & County has a population of 113,795

2.3 Partner principal response agencies

Other agencies responsible for Emergency Services in this area are:-
(a) Health Service Executive: South region comprising of counties Kerry, Cork, Waterford, Wexford, Carlow and Kilkenny
(b) An Garda Síochána: Waterford Division

2.4 Regional Preparedness

Under certain specific circumstances regional level major emergencies may be declared, with a Plan for Regional Level Co-ordination activated. This will provide for mutual aid, support and co-ordination facilities to be activated in a region, the boundaries of which are determined to suit the exigencies of the particular emergency. There are eight regions in total that have been created for Major Emergency purposes. The regions are shown in the Map overleaf:

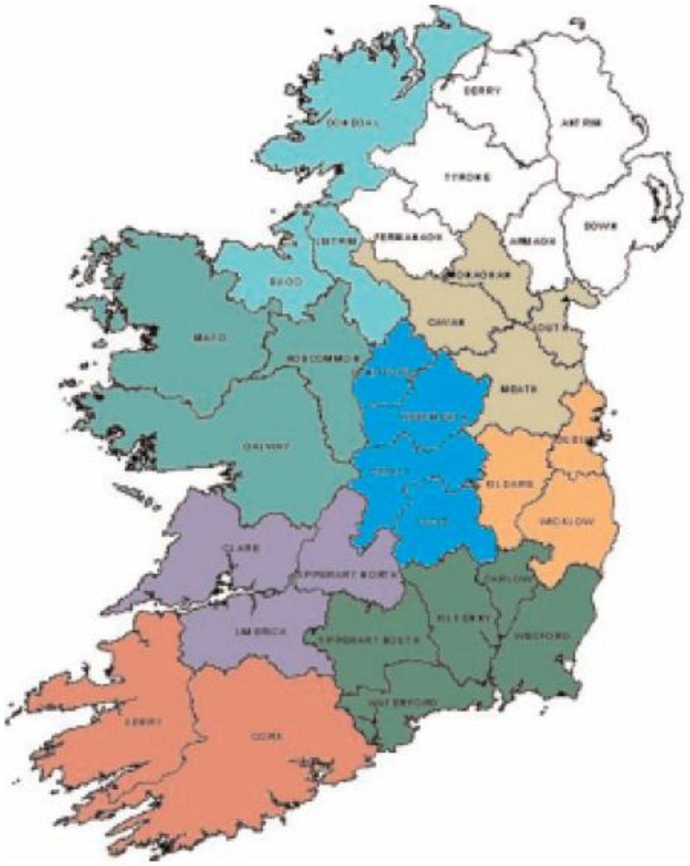


Figure 2.1: Map of the Major Emergency Management regions

Waterford City & County belongs to the South East region. This region incorporates the following counties;

- Carlow
- Kilkenny
- Wexford
- Waterford

An inter-agency Regional Steering Group and Regional Working Group has been formed for the South East Major Emergency Region. This group is representative of senior management from each of the principal response agencies (PRAs).
A Regional Working Group on Major Emergency Management has also been established to support and progress major emergency management in the South-East Region.

Section 3

Risk Assessment for the Area

3.1 History of area in terms of emergency events

To prepare effectively to deal with potential emergencies, it is necessary to have regard to specific risks faced by a community. Risk Assessment is a process by which the hazards facing a particular community are identified and assessed in terms of the risk which they pose.
Major emergencies by their very nature are few and far between. A Major Emergency has to date never been declared in Waterford City & County.

3.2 The general and specific risks that may be faced locally and regionally

A number of risk holdings were identified and risk assessments have been carried out on these premises / area. The risk assessment groups can be broken into the following areas;

1) Hazardous Sites Emergencies:
The European Communities (Control of Major Accident Hazards Involving Dangerous Substance) Regulations, 2006, apply to sites which hold specific quantities of specified dangerous substances. These sites are classified as upper tier and lower tier.

2) Critical Infrastructure Emergencies:

1. National Primary Roads e.g. N25 Rosslare to Cork
2. Iarnród Éireann: Rail line
3. Waterford Regional Hospital.

3) Flooding / Pollution / Animal disease emergencies:

1. Waterford City & County Council

4) Utility company emergencies:

1. Bord Gáis
2. E.S.B.
3. Eircom

5) Aviation & CBNR emergencies:
Following terrorist incidents in recent years, a number of Government Departments are currently involved in planning for emergencies on a national level that involve aviation and CBNR (Chemical, Biological, Nuclear & Radiological agents).
Aviation emergencies such as collisions have also been identified in the risk assessment process.

3.3 Scenarios

The following have been selected as exemplars on which preparedness for Waterford City & County is being based:

- Urban Flooding
- Aircraft Incident
- Water Contamination
- Industrial Incident
- Fire in Assembly Building
- Major RTA/ Hazmat
- Building Collapse due to Gas Explosion
- Loss of Critical Infrastructure
- Rail
- Crowd Safety
- Marine incidents
- Runaway Dyrophosphonate (MSD)
- Loss of Critical IS Infrastructure
- Severe Weather

3.4 Risk management / Mitigation / Risk reduction strategies

By carrying out a risk assessment, we can identify the risks posed to the City and mitigate for their effects. It also enables us to plan and prepare for those risks which can not be eliminated.

The risk assessment process was carried out initially by an inter-agency team, with invited members of An Garda Síochána, the HSE and the Local Authority, before being undertaken and documented by the Major Emergency Development Committee (MEDC). The risk assessment comprises of four stages:

1. Establishing the context
2. Hazard Identification
3. Risk Assessment
4. Recording potential hazards on a risk matrix

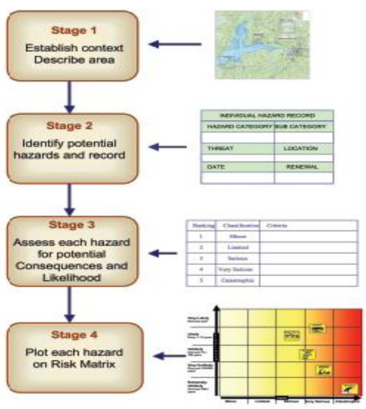


Fig 3.1: Schematic Risk Assessment Process

3.5 Associated Plans and their compatibility with the Major Emergency Plan.

Associated with this PLAN are Section Plans for *(see Appendices):*
Water Supply contamination

Section 4

Resources For Emergency Response

4.1 Structure / Resources / Services of the Council

The organisational structure of Waterford City & County Council can be divided into two parts: firstly the Elected Members and secondly, the Chief Executive Officer and his staff (details of both can be found in Waterford City & County Council Annual Reports).
There are Six Directors of Service at Waterford City & County Council who report directly to the Chief Executive Officer and are responsible for the functioning of their section within the council. These sections are;

- Planning & Corporate
- Water & Environment
- Economic Development
- Housing, Community & Culture
- Roads, HR, & Emergency Services
- Head of Finance, ICT & Cost Management

The Chief Executive Officer is responsible for supervising government operations and implementing the policies adopted by the council.
Each section of the Council may be called upon to act in the event of a Major Emergency.

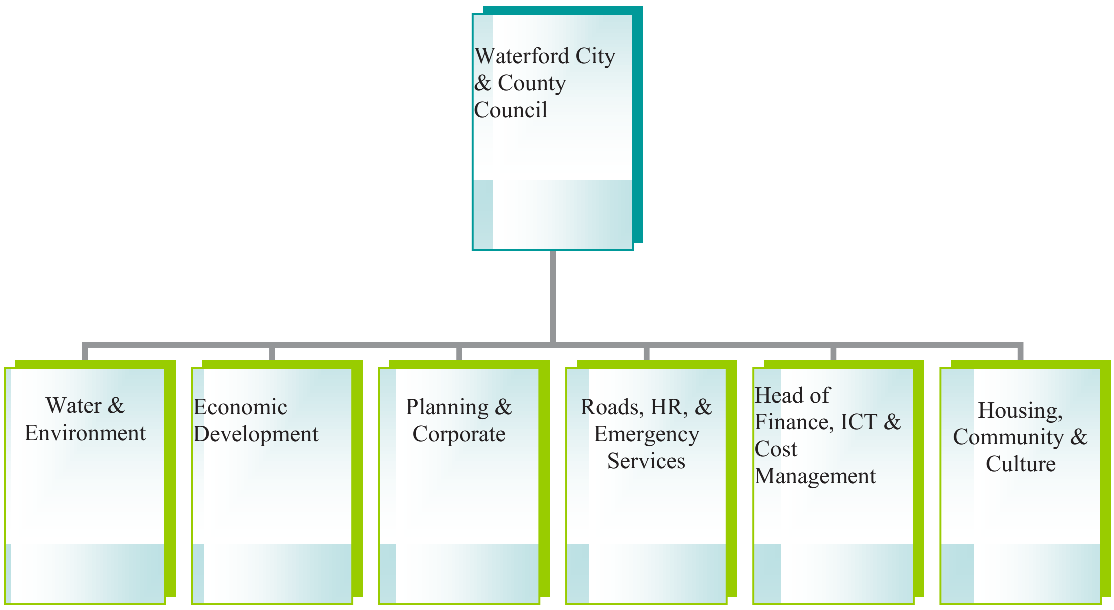


Fig 4.1 Structure within Waterford City & County Council

4.2 Special staffing arrangements during a Major Emergency

The majority of Waterford City & County Council staff requested to carry out functions in relation to a Major Emergency will be mobilised in accordance with pre-determined procedures. In addition the Civil Defence, under the Authority of Waterford City & County Council operate on a call out system, however it is worth considering that their response is completely subject to the availability of volunteers, *see section 4.4.1.*

4.3 Council resources are matched to the functions assigned to it.

Waterford City & County Council will identify, match and formally nominate competent individuals and alternates to the key roles to enable the agency to function in accordance with the common arrangements set out in its Major Emergency Plan.
Support teams will be put in place for key roles and Operational Protocols setting out the arrangements which will enable the agency's support teams to be mobilised and function in accordance with the arrangements set out in the Major Emergency Plan.
Assignment of key roles and how those roles are to be delivered are documented *please see Section 5.4 of this document (see Appendices).*

4.4 Other organisations / agencies that may be mobilised to assist

There are a number of organisations and agencies which may be called upon to assist the principal response agencies in responding to major emergencies in addition to specialist national and local organisations. These organisations may be grouped as follows;

- Defence Forces
- Civil Defence
- Irish Coast Guard
- The Irish Red Cross
- Voluntary Emergency Services (SEMRA (South Eastern Mountain Rescue), River Rescue, SRDA (Search and Rescue Dog Association), Order of Malta).
- Community Volunteers
- Utility companies (ESB, Bord Gáis, Bus Éireann etc)
- Private contractors

4.4.1 Civil Defence

Civil Defence is a body of trained volunteers in the disciplines of First Aid, Rescue, Fire Welfare, river rescue search and recovery. Call out system is in place in the event of an emergency. Civil Defence will be available to help with any area assigned to them to assist the local authority or other Statutory Service, subject to the availability of volunteers.

4.4.2 The Defence Forces

The Defence Forces can provide a significant support role in a major emergency response. However, there are constraints and limitations, and their involvement has to be pre-planned through the development of Memoranda of Understanding (MOU's) and Service Level Agreements (SLA's). Consequently, assumptions should not be made regarding the availability of Defence Forces' resources or materials to respond to a major emergency. Provision of Defence Forces' capabilities is, therefore, dependent on the exigencies of the service and within available resources at the time.
It is recognised that assistance requested from the Defence Forces should be either in Aid to the Civil Power (An Garda Síochána), primarily an armed response or in Aid to the Civil Authority (Local Authority or Health Service Executive), an unarmed response.
All requests for Defence Forces' assistance should be channelled through An Garda Síochána to Defence Forces Headquarters (DFHQ) in accordance with MOUs and SLAs.

4.4.3 The Irish Red Cross

The Irish Red Cross is established and regulated under the Red Cross Acts, 1938-54. These statutes define a role for the Irish Red Cross as an auxiliary to the state authorities in time of emergency and also provide a specific mandate to assist the medical services of the Irish Defence Forces in time of armed conflict. The main relationship with the principal response agencies in major emergency response is as an auxiliary resource to the ambulance services. Subsidiary search and rescue and in-shore rescue units of the Irish Red Cross support An Garda Síochána and the Irish Coast Guard. *(See Appendices Voluntary Emergency Resources)*

4.4.4 Voluntary Emergency Services Sector

Other Voluntary Emergency Services in the Waterford City & County area include *(See Appendices Voluntary Emergency Resources)*:

- Civil Defence
- South Eastern Mountain Rescue Association
- Order of Malta
- Red Cross
- Search and Rescue Dogs Association
- Tramore Sea Rescue Association & Tramore RNLI
- Tramore Cliff Rescue Association
- Waterford Sub-Aqua Club
- Dunmore East Life Boat

4.4.5 The community affected

It is recognised that communities that are empowered to be part of the response to a disaster, rather than allowing themselves to be simply victims of it, are more likely to recover and to restore normality quickly, with fewer long-term consequences.
At an early stage the On-Site Co-ordinator, in association with the other Controllers, should determine if ongoing assistance is required from "casual volunteers'' within the community, so that An Garda Síochána cordoning arrangements can take account of this.
Where the On-Site Co-ordinator determines that casual volunteers should be integrated into the response, it is recommended that the service tasking them, or confirming them in tasks on which they are engaged, should request volunteers to form teams of three to five persons, depending on the tasks, with one of their number as team leader. Where available, orange armbands emblazoned with the word 'Volunteer' or suitable abbreviation, e.g. 'VOL', will be issued by Civil Defence, with whom they will be offered a temporary volunteer status.

4.4.6 Utilities

Utilities are frequently involved in the response to emergencies, usually to assist the principal response agencies in making situations safe. They may also be directly involved in restoring their own services, for example, electricity supply in the aftermath of a storm. It is important that there is close co-ordination between the principal response agencies and utilities involved in or affected by an emergency. Utilities operate under their own legislative and regulatory frameworks but, during the response to an emergency, they need to liaise with the On-Site Co-ordinator. It is also recommended that representatives of individual utilities on site should be invited to provide a representative for the On-Site Co-ordination Group. It is recommended that individual utilities be invited to attend and participate in relevant work of Local Co-ordination Groups. *(See Appendices Resource Contact Personnel and Telephone Numbers)*

4.4.7 Private Sector

Private sector organisations may be involved in a major emergency situation in two ways. They may be involved through, for example, ownership of the site where the emergency has occurred or through ownership of some element involved in the emergency e.g. an aircraft, bus, factory, etc. They may also be called on to assist in the response to a major emergency by providing specialist services and equipment, which would not normally be held or available within the principal response agencies. *(See Appendices)*

4.5 How mutual-aid will be sought from neighbours

The Local Co-ordination Group may request assistance via mutual aid arrangements from a neighbouring County or declare a Regional level emergency and activate the Plan for Regional Level Co-ordination. Support is most likely to be requested from:

- Tipperary County Council
- Kilkenny County Council
- Cork County Council
- Wexford County Council

4.6 Regional level of co-ordinated response

In the event of a Regional level response the lead agency which has declared the regional level emergency will convene and chair the Regional Co-ordination Group. Depending on the circumstances, the goal of regional co-ordination may be achieved by using a single Regional Co-ordination Centre.

The method of operation of a Regional Co-ordination Centre will be similar to that of a Local Co-ordination Centre.

4.7 National / international assistance

In the event that it is necessary to seek assistance from neighbouring or other regions of the country, or from outside the state, this decision should be made by the lead agency in consultation with the other principal response agencies and lead Government Department Liaison Officer at the Regional Co-ordination Centre.

The South-East Regional Co-ordination Group should identify and dimension the level/type of assistance likely to be required and its duration. It should also seek to identify the possible options for sourcing such assistance, be that from neighbouring Regions, elsewhere in the state, the United Kingdom or from other EU member states.

The South-East Regional Co-ordination Group may also request assistance from Government. National resources will be available in the event of a major emergency at local or regional level. Requests for assistance should be developed at local or regional co-ordination level and directed by the lead agency to the lead Government Department.

The European Community has established a Community Mechanism to facilitate the provision of assistance between the member states in the event of major emergencies. Requests for such assistance should be made by the chair of the Waterford City & County Council or South-East Regional Coordination Group to the National Liaison Officer at the Department of the Environment, Community and Local Government.

Section 5

Preparedness for Major Emergency Response

5.1 The incorporation of major emergency management into the Council's business planning process

The development of the Waterford City & County Council Major Emergency plan is part of an emergency management programme development within the Local Authorities to ensure that all necessary arrangements, systems, people and resources are in place to discharge the functions assigned to it. The plan therefore does not stand alone but is in fact incorporated into the Council's management programme. This management programme, which will be implemented on a three year cycle, is designed to maintain a continuous level of preparedness within the County.

5.2 Assignment of responsibility

The Chief Executive Officer for Waterford City & County Council (or designative alternative) is responsible for the principal response agency's major emergency management arrangements and preparedness, as well as for the effectiveness of the agency's response to any major emergency, which occurs in its functional area.

5.3 Documentation of a major emergency development programme

The responsibility for overseeing the Major Emergency Programme within Waterford City & County Council will be assigned to the Director of Services for Roads, HR & Emergency services, whom the Chief Fire Officer will support along with other staff members within the fire services.

5.4 Key roles identified in the Major Emergency Plan.

Waterford City & County Council has nominated competent individuals and alternates to the key roles to enable the agency to function in accordance with the common arrangements set out in its Major Emergency Plan. *(See Appendices).*

5.5 Support teams for key roles

Support teams will be formed to support and assist individuals in key roles and will prepare Operational Protocols setting out the arrangements which will enable the agency's support teams to be mobilized and to function in accordance with the arrangements set out in the Major Emergency Plan.

5.6 Staff development programme

The provisions of the Framework and the tasks arising from the new major emergency management arrangements involve a significant level of development activity, both within Waterford City & County Council and jointly with our regional partners.
In parallel with risk assessment, mitigation processes and the preparation of the Major Emergency Plan, Waterford City & County Council should initiate an internal programme to develop its level of preparedness, so that in a major emergency it will be in a position to respond in an efficient and effective manner and discharge the assigned functions in accordance with the Framework. It is also imperative that we not only develop within our own agency but that we also continue to work with the other PRAs through continued training and inter-agency exercises.

5.7 Training programme

All personnel involved in the Major Emergency Plan organisation will be required to participate in inter-agency training and exercises in order to ensure effective co-operation between agencies during a Major Emergency.

5.8 Internal exercises

Internal exercises will be used to raise awareness, educate individuals on their roles and the roles of others and promote co-ordination and cooperation, as well as validating plans, systems and procedures.

5.9 Joint / inter-agency training and exercise

Joint interagency training will be provided at a Local and Regional level, coordinated by the South East Regional Working group. Exercises will follow on from this training to improve awareness and to educate all involved in the roles and functions of the PRAs in the event of an emergency. Exercises will be preformed on a three yearly cycle.

5.10 The allocation of specific resources including a budget for preparedness

Waterford City & County Council and the South-East Regional Steering Group will provide a budget for major emergency preparedness, which reflects the expenditure required to meet the costs of implementing the agency's internal preparedness, as well as the agency's contribution to the regional level inter-agency preparedness.

5.11 Procurement Procedures

The arrangements to authorise procurement and use of resources (including engaging third parties) to assist in response to major emergencies are governed by the 'Local Government Act: Part 12: Section 104'.

5.12 Annual appraisal of preparedness

Waterford City & County Council will carry out and document an annual internal appraisal of its preparedness for major emergency response; it shall then be sent for external appraisal to the Department of Environment, Community and Local Government in accordance with the Appraisal Document.
An annual appraisal of the South East Regional level preparedness shall also be documented, again in accordance with the Appraisal guidance Document.

5.13 Steps taken to inform the public as to what action they should take in the event of an emergency

There may be situations where it will be crucial for Waterford City & County Council to provide timely and accurate information on an emergency situation directly to the public. This will be especially important where members of the public may perceive themselves and their families to be at risk and are seeking information on actions which they can take to protect themselves and their families.

The Local Co-ordination Group will take over the task of co-ordinating the provision of information to the public as soon as it meets. This activity should be co-ordinated by the lead agency. The Local Co-ordination Group may establish a sub-group for this purpose and use all available channels to make concise and accurate information available. This may include the use of dedicated "help-lines", web-pages, Aertel, automatic text messaging, as well as through liaison with the media.

Section 6

The Generic Command, Control and Co-ordination Systems

6.1 Command arrangements

The Chief Executive Officer of Waterford City & County Council is responsible for the principal response agency's major emergency management arrangements and preparedness, as well as for the effectiveness of the agency's response to any major emergency which occurs in its functional area.

6.1.1 Individual services belonging to the Council

Waterford City & County Council shall exercise command over its own services in accordance with its normal command structure. At the site of an emergency, it will also co-ordinate, not only its own services, but any additional services (other than the principal response agencies) which the Local Authority mobilises to the site. Control of the Local Authority services at the site of the Emergency shall be exercised by the Controller of Operations.

6.2 Control arrangements

Waterford City & County Council shall appoint a Controller of Operations at the site (or at each site) of the emergency. The officer in command of the initial response of each principal emergency service should be the principal response agency's Controller of Operations until relieved through the agency's pre-determined process.
Please see section 6.3.4.2 for arrangements where an emergency affects an extensive area or occurs near the borders.

6.2.1 Control of all services / sections of the Council which respond.

Controller of services / sections and Controller of Operations

The controller of operations is empowered to make all decisions relating to his/her agency's functions, but must take account of decisions of the On-Site Co-ordination Group in so doing.
The roll of the Controller of Operations is set out below:

- To make such decisions as are appropriate to the role of controlling the activities of his/her agency's services at the site (Controlling in this context may mean setting priority objectives for individual services; command of each service should remain with the officers of that service);
- To meet with the other two controllers and determine the lead agency;
- To undertake the role of On-Site Co-ordinator, where the service s/he represents is identified as the lead agency;

- To participate fully in the site co-ordination activity, including the establishment of a Site Management Plan;
- Where another service is the lead agency, to ensure that his/her agency's operations are co-ordinated with the other principal response agencies, including ensuring secure communications with all agencies responding to the major emergency at the site;
- To decide and request the attendance of such services as s/he determines are needed;
- To exercise control over such services as s/he has requested to attend;
- To operate a Holding Area to which personnel from his/her agency will report on arrival at the site of the major emergency and from which they will be deployed;
- To requisition any equipment s/he deems necessary to deal with the incident;
- To seek such advice as s/he requires;
- To maintain a log of his/her agency's activity at the incident site and decisions made;
- To contribute to and ensure information management systems operate effectively;
- To liaise with his/her principal response agency's Crisis Management Team on the handling of the major emergency.

On-Site Co-ordinator

Is empowered to make decisions, as set out below. Decisions should be arrived at generally by the consensus of the On-Site Co-ordinating Group. Where consensus is not possible, the On-Site Co-ordinator should only make decisions after hearing and considering the views of the other two Controllers.

The mandate of the On-Site Co-ordinator is set out below:

- To assume the role of On-Site Co-ordinator when the three controllers determine the lead agency. Once appointed s/he should note the time and that the determination was made in the presence of the two other controllers on site;
- To inform all parties involved in the response that s/he has assumed the role of On-Site Co-ordinator;
- To determine which facility should be used as the On-Site Co-ordination Centre. Depending on the circumstance, this may be a vehicle designated for the task, a specific, purpose-built vehicle, a tent or other temporary structure or an appropriate space/building adjacent to the site, which can be used for coordination purposes;
- To ensure involvement of the three principal response agencies and the principal emergency services (and others, as appropriate) in the On-Site Co-ordination Group;
- To ensure that mandated co-ordination decisions are made promptly and communicated to all involved;
- To ensure that a Scene Management Plan is made, disseminated to all services and applied;
- To develop an auditable list of Actions (an Action Plan) and appoint an Action Management Officer where necessary;

- To determine if and what public information messages are to be developed and issued;
- To ensure that media briefings are co-ordinated;
- To ensure that pre-arranged communications (technical) links are put in place and operating;
- To ensure that the information management system is operated, including the capture of data for record-purposes at regular intervals;
- To ensure that the ownership of the lead agency role is reviewed, and modified as appropriate;
- To ensure that inter-service communication systems have been established and that communications from site to the Local Co-ordination Centre have been established and are functioning;
- To exercise an over-viewing role of all arrangements to mobilise additional resources to the site of the major emergency, and to track the status of mobilization requests, and deployment of additional resources;
- To ensure that, where the resources of an individual principal response agency do not appear to be sufficient to bring a situation under control, or the duration of an incident is extended, support is obtained via mutual aid arrangements with neighbouring principal response agencies;
- To determine, at an early stage, if ongoing assistance is required from casual volunteers, so that An Garda Síochána cordoning arrangements can take account of this;
- To co-ordinate external assistance into the overall response action plan;
- To ensure that, where appropriate, pastoral services are mobilised to the site and facilitated by the principal response agencies in their work with casualties;
- To work with the Health Service Executive Controller to establish the likely nature, dimensions, priorities and optimum location for delivering any psychosocial support that will be required, and how this is to be delivered and integrated with the overall response effort;
- To decide to stand down the major emergency status of the incident at the site, in consultation with the Controllers of Operations, and the Local Co-ordination Group;
- To ensure that all aspects of the management of the incident are dealt with before the response is stood down; and
- To ensure that a report on the co-ordination function is prepared in respect of the major emergency after it is closed down, and circulated (first as a draft) to the other services that attended.

Local Co-ordination Group:

Once the Local Co-ordination Group has been activated the mandate is as follows:

- To establish high level objectives for the situation, and give strategic direction to the response;
- To determine and disseminate the overall architecture of response co-ordination;
- To anticipate issues arising;
- To provide support for the on-site response;

- To resolve issues arising from the site;
- To ensure the generic information management system is operated;
- To take over the task of co-ordinating the provision of information for the public as soon as it meets and use all available channels to make concise and accurate information available;
- To decide and to take action to manage public perceptions of the risks involved, as well as managing the risks, during emergencies that threaten the public;
- To co-ordinate and manage all matters relating to the media, other than on-site;
- To establish and maintain links with the Regional Coordination Centre (if involved);
- To establish and maintain links with the lead Government Department/National Emergency Co-ordination Centre;
- To ensure co-ordination of the response activity, other than the on-site element;
- To decide on resource and financial provision; and
- To take whatever steps are necessary to start to plan for recovery.

Crisis Management Team

The Crisis Management Team is a strategic level management group within each principal response agency, which is assembled during a major emergency to:

- Manage, control and co-ordinate the agency's overall response to the situation;
- Provide support to the agency's Controller of Operations on site and mobilise resources from within the agency or externally as required;
- Liaise with the national head quarters of An Garda Síochána and the Health Service Executive, and relevant Government Departments on strategic issues; and
- Ensure appropriate participation of the agency in the inter-agency co-ordination structures.

The members of the Crisis Management Team are the designate of the agency, who will meet at a pre-arranged location (usually in the agency's headquarters) designated for this use. The use of Crisis Management Teams within each of the principal response agencies facilitates the mobilisation of senior staff to deal with the crisis, in light of the evolving situation, rather than leaving multiple roles to a small number of individuals who hold key positions. In this way, the objectives of prioritising and managing a protracted crisis can be dealt with effectively, while keeping the day-to-day business running.

The Crisis Management Team provides support to the principal response agency's representative at the Local Co-ordination Group, supports their own Controller of Operations on site and maintains the agency's normal day-to-day services that the community requires.

6.2.2 Control of external organisations / agencies mobilised to assist the Council during the response

There are a number of organisations and agencies, which may be called on to assist the principal response agencies in responding to major emergencies. The arrangements for this assistance should be agreed with each agency.
At the site of an emergency, Waterford City & County Council will exercise control over not only its own services but any additional services (other than the principal response agencies) which the Local Authority mobilises to the site.

6.2.3 Support arrangements for the Control function

Waterford City & County Council staff will respond to any M.E. in accordance with pre determined agreements. The Crisis Management Team will control all Local Authority personnel that respond to the emergency.

6.3 Co-ordination Arrangements

The co-ordination of the efforts of all services is recognised as a vital element in successful response to major emergencies, so that the combined result is greater than the sum of their individual efforts. S*ee section 6.2.1 of this document for Co-Ordination Arrangements.*

6.3.1 Lead Agency

The concept of the Lead Agency is accepted as the method for establishing which Agency has initial responsibility for Coordination of all Services on the site of a Major Emergency. The predetermined and default agencies for different types of emergencies are set out in the *Appendices*

6.3.2 Specify how the Council will perform the On Site Co-ordination function, including arrangements for support teams

On-site Co-ordination is facilitated by the On-Site Controller of Operations and the On-Site Co-ordination group. The roles of the On-site Co-ordinator and the On-Site Co-ordination group have been outlined in *section 6.2.1 of this document*.

6.3.3 Specify how the Council will perform the co-ordination function at the Local / Regional Co-ordination Centres

When a major emergency has been declared and the lead agency determined, the relevant personnel of the lead agency should implement a Local Co-ordination Group mobilization procedure. The representative of the lead agency will chair the Local Co-ordination Group, located in the Local Co-ordination centre, and will exercise the

mandates associated with this position. The Local Coordination Group will comprise representatives of the other two PRAs, an Information Management Officer, a Media Liaison Officer, an Action Management Officer (where considered appropriate), representatives of other agencies and specialists, as appropriate.
The Chair of the Local Co-ordination Group may declare a regional level emergency and activate the Plan for Regional Level Co-ordination and in doing so activates a "Regional Coordination Group" to maintain co-ordination of the principal response agencies involved from the extended "response region."
Any one of the nominated Local Co-ordination Centres may be used as a Regional Coordination Centre, or a specific Regional Centre may be designated for this purpose. The choice of location will be determined in each situation by the Chair of the Local Coordinating Group declaring the regional level emergency and will depend on the location and nature of the emergency and any associated infrastructural damage.

6.3.4 Specify how co-ordination is to be achieved in other specific circumstances

When an incident occurs to which no pre-nominated lead agency has been assigned, the default lead agency will be the Local Authority.

6.3.4.1 Mutual aid and regional level co-ordination will operate

Each Controller of Operations should ensure that, where the resources of his/her individual principal response agency do not appear to be sufficient to bring a situation under control, or the duration of an incident is extended, support is obtained via mutual aid arrangements with neighbouring principal response agencies. As they are national organisations, the Crisis Management Teams of the Health Service Executive and An Garda Síochána should arrange to provide the additional support required; Local Authorities will support each other on a mutual aid basis. *See section 4.5 and 4.6 of this document.*

6.3.4.2 How incidents occurring on the Council boundaries are to be dealt with

In certain situations, e.g. where an emergency affects an extensive area or occurs near the borders of Divisions of An Garda Síochána or areas of the Health Service Executive or of the Local Authorities, there may be response from multiple units of the PRA. There should be only one Controller of Operations for each of the three PRAs and it is necessary to determine from which unit of the principal response agency the Controller of Operations should come.
In the case of Local Authorities, which are statutorily empowered in respect of their functional areas, procedures for resolving such issues may already be set out in what are referred to as Section 81 agreements. Where they are not so covered and the issue cannot be resolved quickly in discussion between the responding officers of the different units of those services, the Local Authority Controller of Operations from the Local Authority, whose rostered senior fire officer was first to attend the incident, should be the designated person

6.3.4.3 How multi-site or wide area emergencies are to be dealt with

Multi-site or wide area emergencies may require the setting up of multiple On-site Co-ordination Centres which will feed into the one Local Co-Ordination Group.

6.3.4.4 How links with National Emergency Plans will operate

The Waterford City & County MEP will operate as an integral part of any National plans developed for scenarios affecting the population on a National Level. *(See Appendices)*

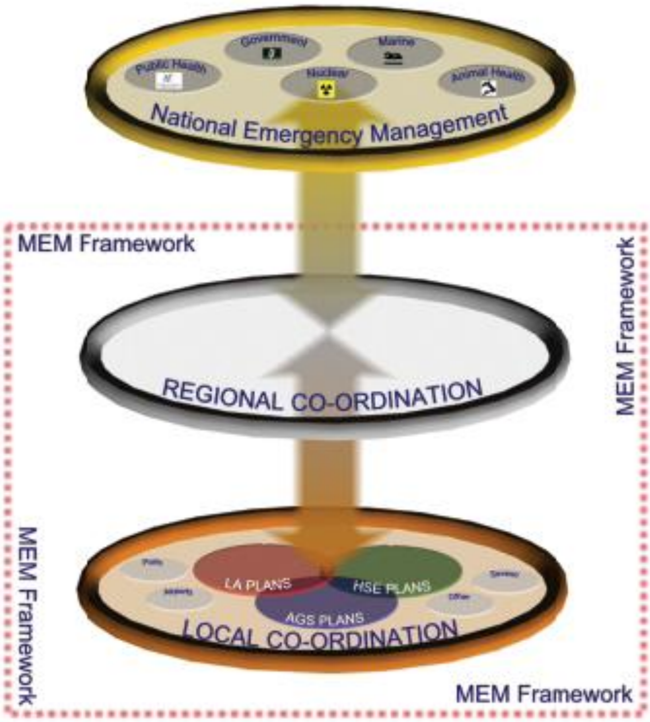


Figure 6: Linking Major Emergency Plans with National Plans and Other Plans

6.3.4.5 How links with National Government will work

In every situation where a Major Emergency is declared, each principal response agency should inform its parent Department of the declaration, as part of that agency's mobilisation procedure. The three parent Departments, should then consult and agree, which Department will be designated as Lead Department, in keeping with the directions set out in "A Framework for Major Emergency Planning".

Section 7

The Common Elements of Response

7.0 Sub-sections setting out how the following common elements of the response to any major emergency will be implemented

7.1 Declaring a Major Emergency

7.2 Initial Mobilisation

7.3 Command, Control and Communication Centres

7.4 Co-ordination Centres

7.5 Communications Facilities

7.6 Exercising the Lead Agency's Co-ordination Roles

7.7 Public Information

7.8 The Media

7.9 Site Management Arrangements

7.10 Mobilising Additional Resources

7.11 Casualty and Survivor Arrangements

7.12 Emergencies involving Hazardous Materials

7.13 Protecting Threatened Populations

7.14 Early and Public Warning Systems

7.15 Emergencies arising on Inland Waterways

7.16 Safety, Health and Welfare Considerations

7.17 Logistical Issues/ Protracted Incidents

7.18 Investigations

7.19 Community/ VIPs/ Observers

7.20 Standing-Down the Major Emergency

Section 7.1

Declaring a Major Emergency

7.1.1 Declaring a Major Emergency

The Major Emergency Plan should be activated by whichever of the following agencies first becomes aware of the major emergency:-

- Waterford City & County Council *(see Appendices for persons authorised to activate plan)*
- An Garda Síochána
- Health Service Executive

A typical message to declare a major emergency shall be in the following format:

This is ……………….. (Name, rank and service) ……………..
A ….…… (Type of incident) …..…. has occurred/is imminent at ……
(Location) …….........................……
As an authorised officer I declare that a major emergency exists.
Please activate the mobilisation arrangements in the ……….. (Agency) ……….. Major Emergency Plan.

7.1.2 Standard format of the information message

After the declaration is made the Officer should then use the mnemonic **METHANE** to structure and deliver an information message.

M	**Major Emergency Declared**
E	**Exact location of the emergency**
T	**Type of Emergency (Transport, Chemical, etc.)**
H	**Hazards, present and potential**
A	**Access / egress routes**
N	**Number and type of Casualties**
E	**Emergency service present and required**

Section 7.2

Initial Mobilisation

7.2.1 Major Emergency Mobilisation Procedure

Waterford City & County Council Major Emergency Mobilisation Procedure will be implemented immediately on notification of the declaration of a major emergency. When this Plan has been activated, each Local Authority service requested shall respond in accordance with pre-determined arrangements. *See Appendices*

In some situations, there may be an early warning of an impending emergency. Mobilisation within Waterford City & County Council may include moving to a standby/alert stage for some of its services or specific individuals, until the situation becomes clearer.

There may also be circumstances where the resources or expertise of agencies other than the principal response agencies will be required. In these situations the relevant arrangements outlined in the Major Emergency Plan will be invoked. No third party should respond to the site of a major emergency unless mobilised by one of the principal response agencies through an agreed procedure.

Section 7.3

Command, Control and Communication Centres

7.3.1 Command, control and communication centre(s) to be used

In the event of a Major Emergency being declared, initial mobilisation will be covered by Munster Regional Control Centre (MRCC), who will communicate with the personnel on-site until such time as the Crisis Management Team and Co-ordination Group have been established in accordance with national pre-determined arrangements. *Please refer to Section 6 of this document for further details on the functions of these Teams/Groups*.

Section 7.4

Co-ordination Centres

7.4.1 On-Site Co-ordination

An onsite co-ordination centre will be deployed in the event of a major emergency for onsite operational support and command. This may be a dedicated vehicle, tent or an adjacent building that will accommodate all Principal Reponses Agencies.

7.4.2 Crisis Management Team

PRAs within Waterford City & County have identified the following locations as suitable Local Co-ordination Centres for strategic level co-ordination:

- Waterford City & County Council Civic Offices -City Hall
- Dungarvan fire station
- Alternative: Garda Station, Ballybricken.

These buildings have been chosen to facilitate the effective working of the Local Co-ordination Group and Local Authority Crisis Management Team. Strategic level co-ordination is more usually exercised at the Local Co-ordination Centre. All co-ordination centres will follow a generic model of operation. The generic centre illustrated below has the following characteristics.

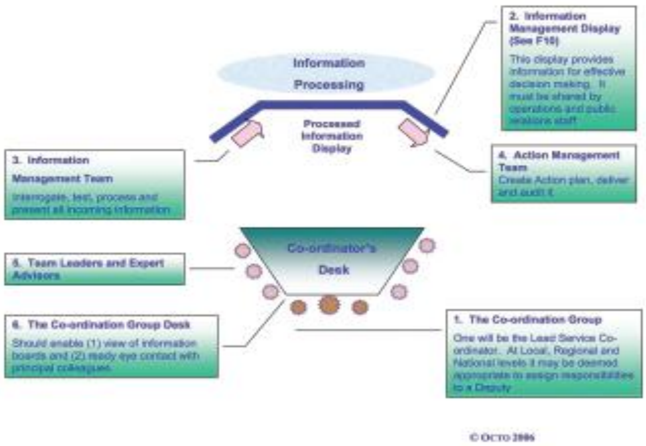


Figure 7: Generic Co-ordination Centre

Please refer to Section 6 of this document for further details.

7.4.3 Location of pre-determined Local Co-ordination Centres

The Co-ordination Centre will be established taking guidance from the document 'Guidance to setting up a Co-ordination Centre.'

7.4.4 Location of the predetermined Regional Co-ordination Centre(s)

The local co-ordination centres will have the capacity to act as a regional co-ordination centre, should the Major Emergency be scaled up to a regional level.

7.4.5 Information Management

The role of Information Manager will be assigned to senior management. The function of the information management team will be to interrogate, test, process and present all incoming information required for the decision making process.

- Action Management Officer / Team:

The function of this role is to assemble an Action Plan (from information that has come from the Information Management System) and ensure that it is communicated to all agencies responsible for delivering it, and to monitor / audit delivery, as well as reporting this back to the Co-ordination Group (a generic system which operates at all levels). At less complex incidents one Officer / Team may undertake both the information and action management functions. Where the demands of the Major Emergency require the appointment of a separate Action Management Officer, this person may be a representative from one of the agencies other than the lead agency.

- Team Leaders and Expert Advisors:

A range of specialist team leaders and expert advisers may be assigned permanent or temporary seats at the Co-ordination Group desk. They may themselves lead teams either at or remote from the centre. Generally they should advise or direct activity strictly within their mandate of Authorities. On occasion they may be invited to contribute to debate in a broader context. They need to be quite clear in which capacity they are acting at any juncture and adjust their perspective accordingly.

- Support Teams:

Each PRA should put support teams in place for key roles and should prepare Operational Protocols setting out the arrangements which will enable the agency's support to be mobilised and function in accordance with this MEP.

Section 7.5

Communications Facilities

7.5.1 Communications Systems

Waterford City & County Council relies on technical communication facilities to enable it to function and for different units to communicate, both at the site and between the site and its command, control or communications centre. Radio and other communications facilities are vital tools for the Local Authority.

- Civil Defence

The Civil Defence operate both mobile radio (VHF) for communication between vehicles and communication centres and hand-portable radio (UHF) for communication on site. A digital multi-line phone and fax service is also available at Civil Defence Headquarters.

- Fire Service

All front line appliances are equipped with radios and have the ability to communicate within the functional area of Waterford City & County. Also the fire service has hand held radios UHF available on all its appliances.

7.5.2 Inter-agency communication on site, including protocols and procedures

Communication systems serve command structures within services and it is neither necessary nor desirable that there is inter-agency radio communication at all levels. However, it is critical that robust arrangements for inter-agency communication on site(s) are provided for at Controller of Operations level as a minimum. For this purpose, the Civil Defence will bring a set of hand-portable radios, dedicated specifically to inter-agency communication, to the site.

7.5.3 Communications between site and coordination centres

All communication between the On-site Co-ordination centre and the Local Co-ordination centre shall pass between the Controller of Operations / On-site Co-ordinator to the Local Co-Ordination group, supported by the work of trained Information Management Officers at the scene and at the co-ordination centres. Communications between the site and the co-ordination centre will be facilitated by way of radio / phone system available to relevant personnel at the time.

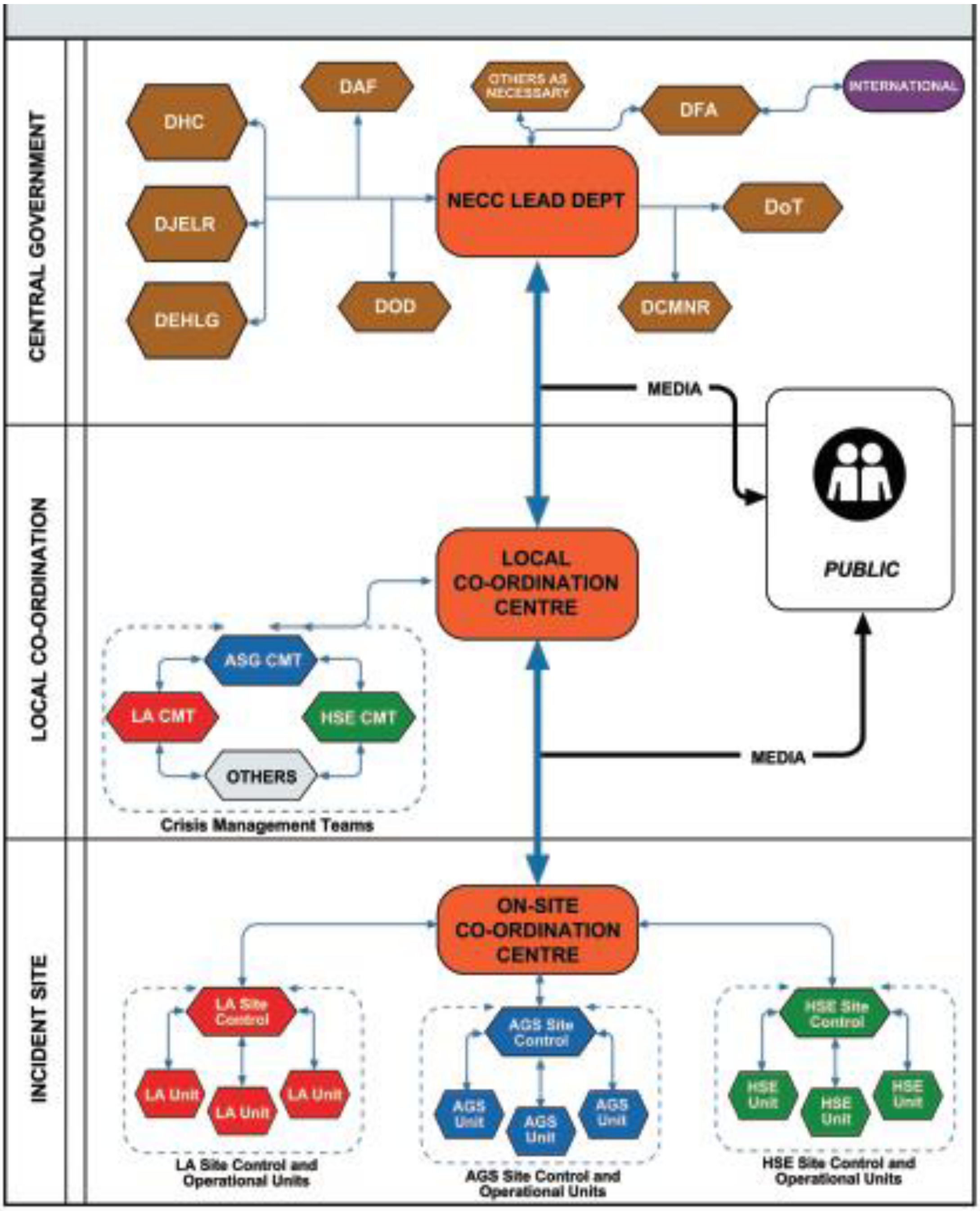


Figure 7.1: Communication

Section 7.6

Exercising the Lead Agency's Co-ordination Roles

7.6.1 Lead Agency

One of the three PRAs will be designated as the lead agency for any emergency and will assume responsibility for leading co-ordination. *See Section 6.3.1 of this Document.*

7.6.2 Review and transfer of the Lead Agency

The lead agency role may change over time, to reflect the changing circumstances of the major emergency. Ownership of the lead agency mantle should be reviewed at appropriate stages of the major emergency. All changes in lead agency designation emanating from the site, and the timing thereof, will be by agreement of the three Controllers of Operations, and should be recorded and communicated as per the initial determination, informing the Local Co-ordinating group. As the emphasis of operations may shift from the site to other areas, the Local Co-ordination Group may review the issue and determine a change in the lead agency, as appropriate.

7.6.3 Council's co-ordination function as a "Lead Agency"

In the event of Waterford City & County Council being assigned the lead agency role, it will be assigned the responsibility for the co-ordination function (in addition to its own functions) and it should lead all the co-ordination activity associated with the emergency both on-site and off-site, and make every effort to achieve a high level in co-ordination. The function of the lead agency for any emergency includes ensuring:

- involvement of the three PRAs and the principal emergency services in sharing information on the nature of the emergency situation;
- involvement of the range of organisations (other than PRAs) who may be requested to respond in co-ordination activities and arrangements;
- mandated co-ordination decisions are made promptly and communicated to all involved;
- site management issues are addressed and decided;
- public information messages and media briefings are co-ordinated and implemented;
- pre-arranged communications (technical) links are put in place and operating;
- operating the generic information management systems;
- ownership of the lead agency role is reviewed, and modified as appropriate;
- all aspects of the management of the incident are dealt with before the response is stood down;
- a report on the co-ordination function is prepared in respect of the emergency after it is closed down, and circulated (first as a draft) to the other services which attended.

Section 7.7

Public Information

7.7.1 Council's role in situations where warning arrangements are needed

There are circumstances when it may be necessary to protect members of the public who are in the vicinity of an emergency event. This protection is usually achieved by moving people temporarily to a safe area, by evacuation where appropriate or feasible, or by advising affected individuals to take shelter in an appropriate place. The On-Site Co-ordinator will take the decision on how best to protect a threatened population, after consultation with the other Controllers of Operations.
The Local Co-ordination Group should manage the task of co-ordinating the provision of information to the public as soon as it meets. This activity should be co-ordinated by the lead agency.

7.7.2 Public Notices

Early warning and special public notices shall be relayed in the event of an emergency. The Public can be kept informed by use of the following:

- Internet service, www.waterfordcouncil.ie ;
- Local broadcasters;
- Emergency helpline service.

On a national level the public shall be informed by use of the following;

- Television and Radio – arrangements exist whereby emergency announcements may be made on RTÉ television and radio channels.
- Television Text Services – not for emergency alerts, but useful for posting more information than would be communicable by emergency calls or broadcasts.

Please refer to a 'Guide to working with the Media' for further information. *See Appendices for useful phone numbers.*

Section 7.8

The Media

7.8.1 Arrangements for liaison with the media

The media will respond quickly to a large-scale incident and this media presence may extend into days or weeks. It is the responsibility of the lead agency to establish a Media Centre at or near the site of the emergency for use by the principal response agencies in dealing with the media at the site. The Local Co-ordination Group will be responsible for official media statements and press releases off-site. *Please refer to a 'Guide to working with the Media' for further information.*

7.8.2 Specify arrangements for media on-site

There shall be a media Liaison Officer appointed at both the Onsite and Local Co-ordination Centres.
The Media Liaison Officer must keep accurate and timely information on the emergency so that in consultation with the local Co-ordination Groups:

- He/She can be the point of contact for all media enquiries.
- He/She can answer information queries from the general public.
- He/She can obtain and provide information from/to Rest Centres, other agencies, press officers, local radio, press etc.
- He/She will be responsible for setting up an information helpline.

7.8.3 Arrangements for media at Local and / or Regional Co-ordination centres

The Local/Regional Co-ordination Group should take the lead in terms of working with the media, away from the site, during a major emergency. As with arrangements at the site, each principal response agency should designate a Media Liaison Officer at the Local Coordination Centre and the activities of the Media Liaison Officers should be co-ordinated by the Media Liaison Officer of the lead agency. All statements to the media at this level should be cleared with the chair of the Local/Regional Co-ordination Group.

7.8.4 Arrangements for media at, or adjacent to, other locations associated with the major emergency

In many situations media attention will move quickly away from the site to other locations, including the Local Co-ordination Centre, hospitals and mortuaries. The Local Co-ordination Group should take the lead in terms of working with the media, away from the site. As with arrangements at the site, each PRA should designate a Media Liaison Officer at the Local Coordination Centre and the activities of these officers should be co-ordinated by the Media Liaison Officer of the lead agency. All statements to the media at this level should be cleared with the chair of the Local Co-ordination Group.

Site Management Arrangements

7.9.1 Generic site management elements/arrangements

Waterford City & County Council shall appoint a Controller of Operations at the site (or at each site) of the emergency; *see section 6.2 of this document*. The initial important task of the Controller of Operations in association with the other two Controllers is the development of a Site Management Plan. Once agreed, the resulting site plan should be implemented and communicated to all responding groups.

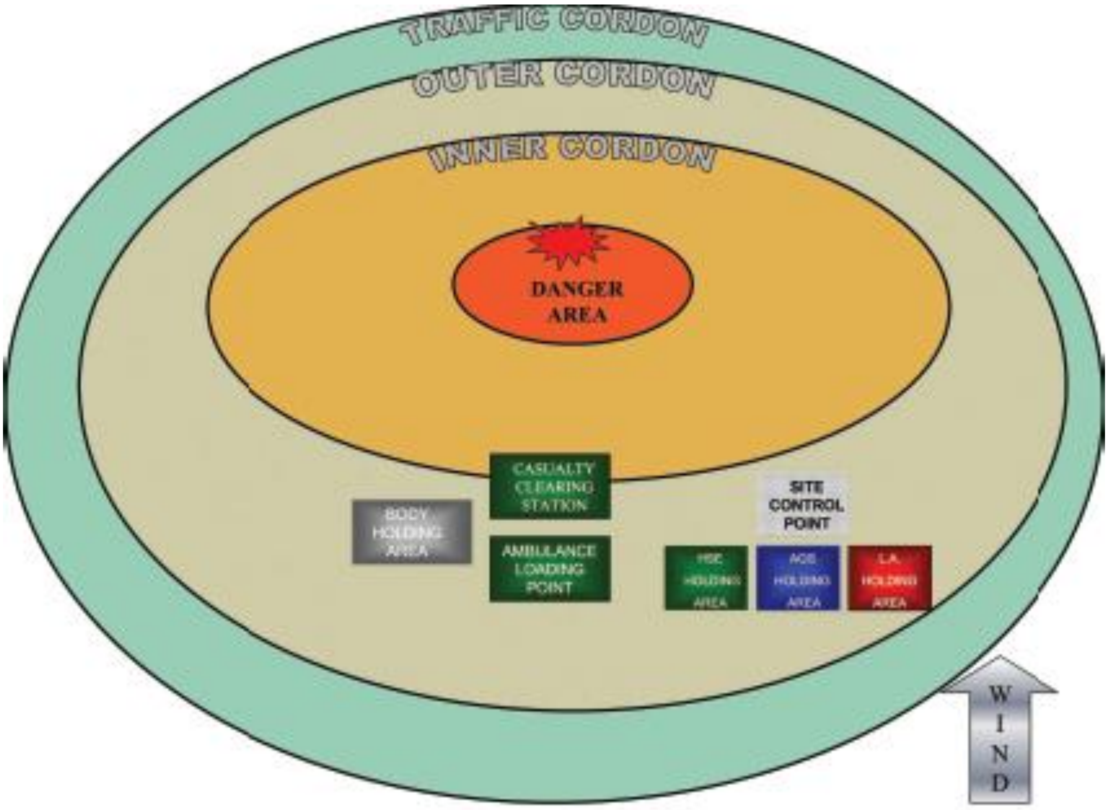


Figure 7.2: Idealised Scene Management Arrangements

The main components of a typical Site Plan should contain some or all of the following:
(See Appendices for detailed information on Scene Management)

- Inner, Outer and Traffic Cordons;
- A Danger Area, if appropriate;
- Cordon and Danger Area Access Points;
- Rendezvous Point;
- Body Holding Area;
- Survivor Reception Centre;
- Friends and Relative Reception Centre;

- Site Access Routes;
- Holding Areas for the Different Services;
- Principal Response Agency Control Points;
- On-Site Co-ordination Centre;
- Media Centre.
- Ambulance Loading Area;
- Casualty Clearing Station;
- Site Control Point;

7.9.2 Control of access / identification of personnel and services of the Council

In order to control access to a Major Emergency site cordons will be established as quickly as possible at the site of a major emergency for the following reasons;

- to facilitate the operations of the emergency services and other agencies;
- to protect the public, by preventing access to dangerous areas; and
- to protect evidence and facilitate evidence recovery at the site.

Three cordons will be established. An Inner, Outer and Traffic Cordon, along with access cordon points.. This will be done by An Garda Síochána after a decision by, and agreement with, the On-site Co-Ordination Group.
A Danger Area may also be declared where there is a definite risk to rescue personnel, over and above that which would normally pertain at emergency operations.

➢ Identification of Personnel at the Site of a Major Emergency

All uniformed personnel, responding to the site of a major emergency, should wear the prescribed uniform, including high visibility and safety clothing, issued by their agency. The service markings on this clothing should be made known in advance to the other organisations that may be involved in the response.

Senior personnel who are acting in key roles, such as the On-Site Co-ordinator and the Controllers of Operations, should wear bibs designed and coordinated as follows:

Organisation	Bib Colour	Wording
Health Service Executive	Green and White Chequer	HSE Controller
Council	Red and White Chequer	Council Controller
An Garda Síochána	Blue and White Chequer	Garda Controller

When the lead agency has been determined, the On-Site Co-ordinator should don a distinctive bib with the words On-Site Co-ordinator clearly visible front and back.

Below is an example of how the bibs should look for each of the responding agencies.

- Non-Uniformed Personnel

Non uniformed personnel from Waterford City & County Council should attend the scene in high visibility jackets with the name Waterford City & County Council and their job function clearly displayed.

7.9.3 Air exclusion zones

Where the principal response agencies consider it appropriate and beneficial, the On-Site Co-ordinator may request, through An Garda Síochána, that an Air Exclusion Zone be declared around the emergency site by the Irish Aviation Authorities. When a restricted zone above and around the site is declared, it is promulgated by means of a "Notice to Airmen" - NOTAM - from the Irish Aviation Authorities.

Section 7.10

Mobilising Additional Resources

7.10.1 Specify the arrangements for mobilising organisations

The Voluntary Emergency Services sector can provide additional equipment and support in the event of a major emergency. Details of the local Voluntary Emergency Services, the resources they can provide and their mobilisation procedure is outlined in the Voluntary Emergency Services will link to the Principal Response Agencies in accordance with the table below.

Principal Response Agency	**Linked Voluntary Emergency Services**
An Garda Síochána	Irish Mountain Rescue Association Irish Cave Rescue Association Search and Rescue Dogs Sub-Aqua Teams River Rescue
Health Service Executive	Irish Red Cross Order of Malta Ambulance Corps St. John's Ambulance
Local Authority	Civil Defence

Each Principal Response Agency with a linked Voluntary Emergency Service is responsible for the mobilisation of that service and their integration into the overall response. The internal command of volunteer organisations resides with that organisation.

7.10.1.1 Mobilisation of Civil Defence

Please refer to section 4.4.1 of this document; details also given in the Appendices

7.10.1.2 Mobilisation of Defence Forces

Please refer to section 4.4.2 of this document; details also given in Appendices

7.10.1.3 Mobilisation of the Irish Red Cross

Please refer to section 4.4.3 of this document; details also given in Appendices

7.10.1.4 Mobilisation of Voluntary Emergency Services

Each Principal Response Agency with a linked Voluntary Emergency Service is responsible for the mobilisation of that service and their integration into the overall response. The internal command of volunteer organisations resides with that organisation

7.10.1.5 Mobilisation of Utilities

Utilities are frequently involved in the response to emergencies, usually to assist the principal response agencies in making situations safe. They may also be directly involved in restoring their own services, for example, electricity supply in the aftermath of a storm. Utilities operate under their own legislative and regulatory frameworks but, during the response to an emergency, it is important that they are involved in the co-ordination arrangements. Utilities may be requested to provide representatives and/or experts to the On-Site Co-ordination Group, the Local Coordination Group and/or the Regional Co-ordination Group, as appropriate. A list of utilities and their emergency/out of hours contact arrangements are listed in the *Appendices* *Please refer to section 4.4.6 of this document for further details.*

7.10.1.6 Mobilisation of Private Sector

Private sector organisations may be involved in a major emergency through ownership of the site where the emergency has occurred or through ownership of some element involved in the emergency e.g. an aircraft, bus, factory, etc. They may also be called on to assist in the response to a major emergency, by providing specialist services and/or equipment. Private sector representatives and/or experts may be requested to support the work of the On-Site Co-ordination Group, the Local Co-ordination Group and/or the Regional Co-ordination Group, as appropriate. A list of experts and equipment within the private sector is detailed in the *Appendices .*

7.10.2 Arrangements for identifying and mobilising additional organisations

The Local Authority Controller of Operations should ensure that, where the resources of the authority do not appear to be sufficient to bring a situation under control, or the duration of an incident is expected to be extended, the levels, types and duration of assistance/ support are identified, and that the request for support is passed to either the authority's Crisis Management Team or the Local Co-ordination Centre who will arrange to obtain the support via mutual aid arrangements with neighbouring authorities.
Where resources that are held at a national level are required, as part of the management of the incident, requests for those resources should be directed by the lead agency to the Lead Government Department.

7.10.3 Arrangements for liaison with utilities

Please refer to section 4.6 of this document; details also given in the *Appendices.*

7.10.4 Arrangements for integration of casual volunteers as appropriate

Please refer to section 4.4.5 of this document.

7.10.5 Arrangements for command, control, co-ordination and demobilisation of organisations mobilised to the site

Each Principal Response Agency with a linked Voluntary Emergency Services/Organisation is responsible for the mobilisation of that service and their disintegration into the overall response. The internal command of the organisations resides with that organisation.
Please refer to section 4.4.1 through 4.4.7 and section 7.10.1 of this document.

7.10.6 Mutual aid arrangements

Please refer to section 4.5 of this document.

7.10.7 Requests for out-of-region assistance

The decision to seek assistance from outside the region will be made by the lead agency, in association with the other principal response agencies, at the Local/Regional Coordination Centre. *Please refer to section 4.7 of this document.*

7.10.8 Requests for international assistance

A Regional Co-ordination Group may also request assistance from Government. National resources will be available in the event of a major emergency at local or regional level. Requests for assistance should be developed at local or regional co-ordination level and directed by the lead agency to the lead Government Department. *Please refer to section 4.7 of this document.*

Section 7.11

Casualty and Survivor Arrangements

7.11.1 General

The primary objective of any response to a major emergency is to provide effective arrangements for the rescue, care, treatment and rehabilitation of all of the individuals who are affected by the emergency. These individuals may be divided into two main categories as follows: Casualties, including persons who are killed or injured, and Survivors. Survivors will include all those individuals who are caught up in an emergency but not injured, such as, uninjured passengers from a transport accident or evacuees.

As well as making provision for casualties and survivors, the principal response agencies should also make arrangements for the reception, facilitation and support of the friends and relatives of some or all of these individuals.

Please refer to a 'Guide to dealing with Mass Casualties', 'Guide to setting up a friends and relative centre', 'Guide to setting up a Survival Reception Centre', for further information.

7.11.1.1 Casualties and Survivors and the Local Authority's role.

The On-Site Co-ordinator, in association with the other Controllers, will need to make an early assessment of the casualty situation and identify if there are particular aspects which may impact on casualty management, such as, significant numbers of disabled, sick or immobile persons involved, and take action accordingly.

Individuals may be divided into two main categories as follows:

- Casualties, including persons who are killed or injured,
- Survivors. These include all those individuals who are caught up in an emergency but not injured, such as, uninjured passengers from a transport accident or evacuees.

7.11.2 Injured

At the site of a major emergency, the priorities of the principal response services are to save life, prevent further injury, rescue those who are trapped or in danger, triage casualties, provide them with appropriate treatment and transport them to the appropriate hospital(s) where necessary.

7.11.2.1 Arrangements for the triage

Triage is a dynamic process of assessing casualties and deciding the priority of their treatment, using a two-stage process of triage sieve and triage sort. Following initial triage, casualties will normally be labelled, using Triage Cards, and moved to a Casualty

Clearing Station. The purpose of this labelling is to indicate the triage category of the casualty, to facilitate the changing of that category, if required, and to record any treatment, procedure or medication administered. A standard card with Red (Immediate), Yellow (Urgent), Green (Delayed) and White (Dead) sections is normally used for this purpose.

7.11.2.2 Transporting lightly injured and uninjured persons from the site

It should be noted that while some casualties will be transported to the Receiving Hospital(s) by the Ambulance Service with assistance from the Local Authority, some casualties may leave the site by other means and may arrive at the designated Receiving Hospital(s), or other hospitals, in cars, buses, etc.

7.11.2.3 Casualty Clearing

Patients must be moved to the Casualty clearing station. The Casualty clearing station will be established by the ambulance service, in consultation with the Health Service Executive. At this location the casualties are collected, further triaged, treated, as necessary, and prepared for transport to hospital. The Health Service Executive Controller will, in consultation with the Site Medical Officer and the designated receiving hospitals, decide on the hospital destination of casualties.

7.11.3 Fatalities

The bodies of casualties, which have been triaged as dead, should not be moved from the incident site unless this is necessary to affect the rescue of other casualties. The only other circumstance where bodies should be moved, before the Garda evidence collection process is complete, is if they are likely to be lost or damaged due to their location or the nature of the incident.
Bodies to be moved should be photographed first and their original position clearly marked and recorded. The recovery of the dead and human remains is part of an evidence recovery process and, as such, is the responsibility of An Garda Síochána acting as agents of the Coroner. The Local Authority can assist An Garda Síochána in this function. *The Mass Fatality Plan will be available on the website 'MEM.ie' when it is available..*

7.11.3.1 Coroners role

The Coroner is an independent judicial officer, who has responsibility for investigating all sudden, unexplained, violent or unnatural deaths. It is the task of the Coroner to establish the 'who, when, where and how' of unexplained death. All such deaths in Ireland are investigated under the Coroners' Act, 1962. *The Mass Fatality Plan will be available on the website 'MEM.ie' when it is issued.*

7.11.3.2 Arrangements for dealing with fatalities, both on and off-site, including Body Holding Areas and Temporary Mortuaries

The On-Site Co-ordinator, in association with the other Controllers, will decide if it is necessary to establish a Body Holding Area at the site. The Body Holding Area, if established, should be situated close to the Casualty Clearing Station. Members of An Garda Síochána will staff this area and they will maintain the necessary logs to ensure the continuity of evidence.

It should be noted that the Body Holding Area is not the appropriate place for the prolonged storage of the dead and appropriate arrangements should be made to ensure minimal delay in moving bodies to a mortuary (temporary or otherwise).

- Temporary Mortuaries

It is the responsibility of the Local Authorities to provide a Temporary Mortuary, if required in consultation with the coroner.

The likely commissioning time for a Temporary Mortuary is of the order of twenty-four hours, and this may extend to forty-eight hours when victim numbers are extensive. It should be noted that a Temporary Mortuary might be required to operate for weeks or months after an incident. *The Mass Fatality Plan will be available on the website 'MEM.ie' when it is issued.*

7.11.3.3 Identification of the deceased

The Coroner, with the assistance of An Garda Síochána, has overall responsibility for the identification of bodies and remains and s/he is entitled to exclusive possession and control of a deceased person until the facts about their death have been established. A full post-mortem and forensic examination will be carried out on every body from a major emergency and each death will be the subject of an Inquest. The post-mortem is carried out by a Pathologist, who acts as the 'Coroners Agent' for this purpose.

7.11.4 Survivors

A Survivor Reception Centre should be designated and established at the earliest possible opportunity. Transport from the Survivor Reception Centre to home/meet relatives/safe place will be arranged as soon as it is practicable. This responsibility will lie with Waterford City & County Council. *Please refer to 'Guide to setting up a Survival Reception Centre' for further information.*

7.11.4.1 Arrangements for dealing with uninjured survivors who require support

A Survivor Reception Centre should be designated and established at the earliest possible opportunity. The On-Site Co-ordinator, in conjunction with the other Controllers, should determine if such a centre is to be established, and its location in the site management plan. It is the responsibility of Waterford City & County Council to establish and run this centre.

Waterford City & County Council has identified the following as suitable buildings for setting up a survivor centre:

- Recreation Centre
- Local School
- Parish Hall
- Any other building that is large enough to accommodate large amounts of people.

All those who have survived the incident uninjured can be directed to the Survivor Centre, where their details will be documented and collated by An Garda Síochána. Provision should be made at this centre for the immediate physical and psychosocial needs of survivors (e.g. hot drinks, food, blankets, telephones, first aid for minor injuries, etc.).
The assistance of Civil Defence and the voluntary ambulance services may be required to provide a variety of services at the Survivor Reception Centre. The Survivor Reception Centre should be secure from any unauthorised access and provide the maximum possible privacy for survivors. *Please refer to 'Guide to setting up a Survival Reception Centre', for further information.*

7.11.5 Casualty Information

Gathering of casualty information will be the responsibility of An Garda Síochána.

7.11.5.1 The Casualty Bureau operated by An Garda Síochána

In the event of a major emergency involving significant numbers of casualties, An Garda Síochána will establish a Casualty Bureau to collect and collate the details (including condition and location) of all casualties and survivors. The release of the dedicated Casualty Bureau number will be done via the media through the Garda Press Office in conjunction with the Casualty Bureau Supervisor and Senior Officer in Charge of the incident. Closure of the Casualty Bureau will take place after consultation between the Casualty Bureau Supervisor and the Senior Garda Officer in charge of the incident and the Inspector in charge of Garda Communications Centre, Harcourt Square.

7.11.5.2 Casualty information

To facilitate this, the Casualty Bureau, a liaison/casualty officer will normally be sent by An Garda Síochána to each hospital, survivor reception centre and casualty reception centre where casualties are being treated. The local Authority may assist in the collection and collation of casualty data. This information may then be used to provide to family and friends. Any information collected on any casualty is transferred via An Garda Síochána to the Casualty Bureau, who will generally set up an information hot line, in order that concerned family and friends may inquire about 'loved ones.'

7.11.6 Friends and Relatives Reception Centres

The purpose of a reception centre is to provide a comfortable area where friends and relatives of those involved in the incident (primarily the casualties and survivors) can be

directed for information. The Local Co-ordination Group will determine the need for and arrange for the designation and operation/staffing of such centres.
A building used as a Friends' and Relatives' Reception Centre should be secure from media intrusion and contain sufficient room to afford privacy to families receiving information about relatives. There will also be a need for a reliable process to establish the credentials of friends and relatives. *Please refer to a 'Guide to setting up a friends and relative centre' for further information.*

7.11.6.1 How friends and relatives of casualties are to be provided for

A reception centre is to provide a comfortable area where friends and relatives of those involved in the incident (primarily the casualties and survivors) can be directed for information. *See section 7.11.6. Please refer to a 'Guide to setting up a friends and relative centre' for further information.*

7.11.7 Non-National Casualties

In some incidents an emergency may involve significant numbers of casualties from other jurisdictions. In such circumstances the Local Co-ordination Centre should notify the relevant embassy if the nationality of the victims is known. The Department of Justice should be approached if assistance is required in obtaining interpreters from private sector providers. The Department of Foreign Affairs (which operates an out of hours Duty Officer System) should also be approached for appropriate assistance and liaison purposes.

7.11.7.1 Foreign language communication resources

Advice may be sought from An Garda Síochána as to the use of interpreters. Generally the local Garda Station will have a list of approved interpreters which may be called upon in the event of an emergency. Advice may also be sought from the Department of Foreign Affairs.

7.11.8 Pastoral and Psychosocial Care

The On-Site Co-ordinator will ensure that, where appropriate, pastoral services are mobilised to the site and facilitated by the PRAs in their work with casualties and survivors. Similarly, individual services should make arrangements for necessary pastoral services at any other locations associated with the emergency, such as hospitals.

7.11.8.1 Responsibility of Pastoral and Psychosocial support arrangements

Pastoral and psycho-social support arrangements for casualties and other affected members of the public are the responsibility of the Health Service Executive. Requests for such care can be made through a HSE crisis management team, which will then make the appropriate arrangements.

Section 7.12

Emergencies involving Hazardous Materials

7.12.1 Arrangements for dealing with major Hazardous Materials incidents

The Local Authority is the lead agency for response to hazardous materials incidents, with the exception of those involving biological agents. Where terrorist involvement is suspected, An Garda Síochána will act as the lead agency. The Defence Forces, when requested, will assist An Garda Síochána in an Aid to the Civil Power role with Explosive Ordnance Disposal teams. Details of specific actions to be taken in the event of a CCBRN incident are contained in the Protocol for Multi-Agency Response to Suspect Chemical and Biological Agents arising from terrorist activity.

7.12.2 CCBRN incidents

Details of specific actions to be taken in the event of a CCBRN (*CCBRN meaning terrorist incidents involving C - conventional explosives; C - chemical substances; B - biological agents; R - radiological and N - nuclear material)* incident are detailed in the Protocol for Multi-Agency Response to Suspect Chemical and Biological Agents (in Draft). These protocols deal with a range of matters relevant to managing such incidents, including the identification of the materials involved. They also provide for involvement of the National Poisons Information Centre and the National Virus Reference Laboratory.
Where terrorist involvement is suspected, An Garda Síochána will act as the lead agency.

7.12.3 Biological incidents

Details of specific actions to be taken in the event of a biological incident are detailed in the Protocol for Multi-Agency Response to Suspect Chemical and Biological Agents (in Draft).

7.12.4 National Public Health (Infectious diseases) Plan

For infectious diseases such as Avian Flu, Pandemic Flu, Foot and Mouth there will be a link to the National Plan as outlined by the government. Waterford City & County Council will provide assistance under the command of the lead government department.

7.12.5 Nuclear Accidents

Details of specific actions to be taken in the event of a local radiological emergency or the activation of the National Emergency Plan for Nuclear Accidents are detailed in the Protocol for Multi-Agency Response to Radiological/ Nuclear Emergencies (in Draft)

7.12.6 Decontamination

The On-Site Co-ordinator, in association with the other Controllers of Operations, will establish the need for decontamination. The Health Service Executive has responsibility for providing clinical decontamination and medical treatment to casualties affected by hazardous materials. The Fire Services have responsibility for providing other forms of physical decontamination of persons at the site. The Health Service Executive will be responsible for decontamination where required to protect health service facilities, such as hospitals, from secondary contamination.

Where emergency decontamination of the public is required, the Local Authority Fire Service may use its fire-fighter decontamination facilities, or improvised equipment may be used prior to the arrival of dedicated equipment. Where it is decided that persons should undergo this practice, it should be carried out under the guidance of medical personnel. It should be noted that emergency decontamination carries risks for vulnerable groups, such as the elderly and the injured. It may be more appropriate in certain circumstances for outer clothing to be removed and blankets provided as a temporary measure to alleviate potential harm through surface contact with contaminants.

Section 7.13

Protecting Threatened Populations

7.13.1 Threatened Population

The On-Site Co-ordinator will take the decision on how best to protect a threatened population, after consultation with the other Controllers of Operations This protection is usually achieved by moving people temporarily to a safe area, by evacuation where appropriate or feasible, or by advising affected individuals to take shelter in an appropriate place.

7.13.2 Evacuation arrangements

The On-Site Co-ordinator will take the decision on how best to protect a threatened population, after consultation with the other Controllers of Operations. Evacuation is usually undertaken on the advice of the Local Authority or Health Service Executive. Where decided upon, the process of evacuation will be undertaken by An Garda Síochána, with the assistance of the other services. In some circumstances, personnel from all services may have to assist in carrying it out. A suitable evacuation assembly point will need to be established and rest centres set up by the Waterford City & County Council.
Personnel from the local authority and from voluntary agencies will staff rest centres. The centres will provide security, welfare, communication, catering and medical facilities. Evacuees should be documented and basic details passed to the casualty bureau. The Local Authority will assist in this role.
Temporary Accommodation may also be required.

Please see sections 7.1 and 7.17.3 for further details on evacuee welfare; also refer to 'A Guidance to Mass Evacuation'.

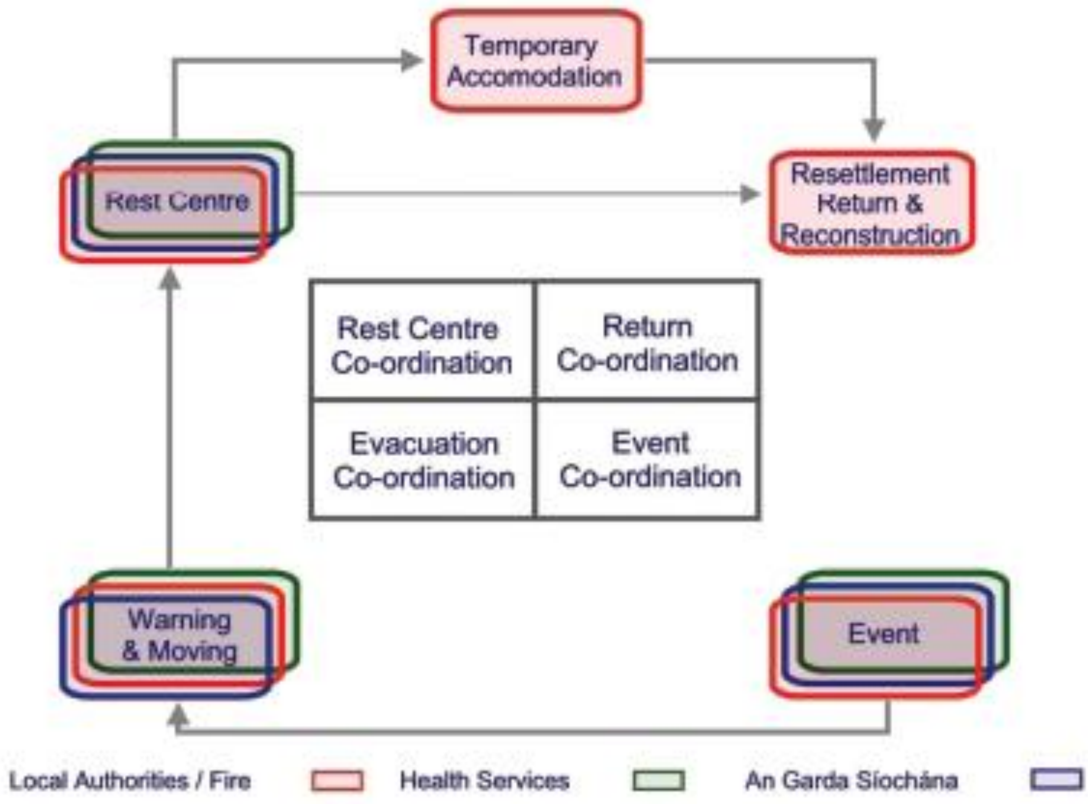


Figure 7.2: Structure of Evacuation

7.13.3 Arrangements for the involvement of The Public Health Service

Where an emergency results in a real or perceived threat to public health by, for example, the release of chemical, radioactive or biological agents, the contamination of water or food supplies, or the spread of contaminated flood water, it can be anticipated that there will be considerable concern among both the persons immediately affected and the wider public. In such situations, the Health Service Executive Controller should ensure that the local public health services are informed of the situation as soon as possible so that they can become involved in the response at the earliest possible stage.

Section 7.14

Early and Public Warning Systems

7.14.1 Monitoring potentially hazardous situations

Early warning systems are currently set in place for Severe Weather forecasts. This is a 24 hour service provided by Met Éireann. There may be a need to inform the public of the current situation or of possible evacuation. *Please refer to Section 11.1 of this document.*
Other such warning systems are in place for Flooding, detailed in the Flood Response Plan, Water contamination etc.

7.14.2 How warnings are to be disseminated.

Warnings may be disseminated to the public by use of some or <u>all</u> of the following mediums:

- Door to Door
- Radio and T.V. broadcasting
- Local helpline / information line
- Web services and internet services
- Automated Text services
- Social Media
- Establish site specific warning systems.

Section 7.15

Emergencies arising on Inland Waterways

7.15.1 Liaison with the Irish Coast Guard

Waterford City & County Council can provide assistance in the form of the Fire Service for water rescue / recovery. There are also some inland water rescue volunteer organisations that may be asked to provide assistance such as River Rescue. *Please refer to the Appendices for further details on resources.*

7.15.2 Receiving 999/112 calls and the mobilising of resources to inland waterway emergencies

The Irish Coast Guard has responsibility for receiving 999/112 calls and the mobilising of resources to Inland Waterway emergencies. An Garda Síochána should be the principal response agency to undertake initial co-ordination at inland waterway emergencies. After the initial response, this role may be re-assigned, following consultation between the Irish Coast Guard and An Garda Síochána.

Section 7.16

Safety, Health and Welfare Considerations

7.16.1 Safety, health and welfare of its staff

Each principal response agency (and other responding organisation) is responsible for the Safety, Health and Welfare of its staff responding to emergencies and should operate its own safety (including personal protective equipment) and welfare management procedures. *Please refer to a 'Local Authority Organisational Safety Statement' for further information.*

7.16.2 Safety of the Council's rescue personnel

When working in the environment of a Major Emergency the On-Site Co-ordinator will apply normal incident and safety management arrangements, a 'Safety Officer' will generally be appointed having responsibility for the oversight and management of the safety of the Council's rescue personnel. All other relevant officers will continue to exercise command over their own personnel working in the area.

7.16.3 Operating within the 'Danger Area'

A 'Danger Area' may be declared at the site where there is a definite risk to rescue personnel over and above that which would normally pertain at emergency operations. The Council is responsible for the health and safety of its staff when they operate within the 'Danger Area'.
Each service should establish from the On-Site Co-ordinator if a Danger Area has been defined (*see Section 7.9.1 of this document*) as part of site management arrangements and, if so, what particular safety provisions may apply.

7.16.4 Procedures and evacuation signal for the 'Danger Area'.

Where a situation deteriorates to a point where the officer in charge of the Danger Area decides that it is necessary to withdraw response personnel from a Danger Area, a signal, comprising of a repeated sounding of a siren for ten seconds on, ten seconds off, will be given. All personnel should withdraw on hearing this signal to a pre-determined safe zone.

7.16.5 Physical welfare of responders (food, shelter, toilets)

Please refer to section 7.17.3 of this document.

7.16.6 Psychosocial support for personnel.

Those who are particularly traumatized by the events of a Major Emergency may require skilled professional help; this will be provided by Waterford City & County Council. Currently a careline exists which enables employees and their immediate family to access confidential advice and support 24 hours a day 365 days a year. This type of service ensures confidentiality and overcomes the cultural resistance in the emergency services to such a step. These facilities should also be made available to support staff, even if they are not directly involved at the scene, e.g. administration staff, drivers and communications staff.

Section 7.17

Logistical Issues/ Protracted Incidents

7.17.1 Arrangements for rotation of front line rescue / field staff

Front line rescue / field staff will be relieved at protracted incidents in accordance with the Local Authority Safety, Health and Welfare arrangements. Crews from the South-East region may be called upon to assist and support the emergency.

7.17.2 Re-organising normal emergency and other services cover

Staff welfare arrangements need to be given priority in the recovery stage of an incident, so that the needs of all staff, both emergency response teams and general staff (including management), are catered for. In addition, the needs of staff that are not directly involved in responding to the incident should also be considered. Those members of staff who continue in their normal work are supporting colleagues in the emergency response and may be taking on additional work in the process. They can be as critical to the organisation's response as those involved at the 'coalface'.

7.17.3 Arrangements for initial and ongoing welfare for field staff

The Local Authority Controller should ensure that appropriate rest and refreshment facilities are provided for response personnel at the site, as well as for survivors. Staff welfare will be considered at all times. Civil Defence may be called upon to provide or aid in the administration of such needs. Welfare facilities such as toilets etc may also be required and supplied by Waterford City & County Council. The Local Authority will strive and endeavour to provide meals at all meal times to field staff or every 4/5 hours during an incident.

Section 7.18

Investigations

7.18.1 Investigations arising from the emergency

The scene of a suspected crime should be preserved until a complete and thorough examination has been made. An Garda Síochána will need to obtain evidence of the highest possible standard and will require that all evidence is left in situ, unless a threat to life or health prevents this. Statements may be required from the members of Local Authority staff on their involvement.

7.18.2 Preservation of evidence

The preservation of the site of a major emergency, which results from criminal action, is of paramount importance and should receive a priority rating from the outset by all PRA's. The first member(s) of An Garda Síochána to arrive at the site of a major emergency where a suspected crime has been committed, automatically incurs the responsibility of preserving the site. While the priority is the protection of life, the provisions of the Framework are intended to assist An Garda Síochána investigative role.

7.18.3 Other parties with statutory investigation roles

Depending on the nature of the Major Emergency, agencies other than An Garda Síochána may require access to the site for the purposes of carrying out an investigation. These agencies include the Health and Safety Authority (HSA), the Air Accident Investigation Unit (AAIU), Environmental Protection Agency (EPA) and Irish Rail. An Garda Síochána is responsible for carrying out criminal investigations.
Any agency including the Local Authority, with an investigative mandate should liaise in the first instance with the On-Site Co-ordinator, who will direct them to the Controller of Operations of An Garda Síochána.

Section 7.19

Community / VIPs / Observers

7.19.1 How links are to be established with communities affected by an emergency

Where communities are affected by a major emergency effort should be made to establish contacts/links with a community utilising established links such as Community Groups/ Public Repetitive and Community Liaison Officers within in the community.

7.19.2 Arrangements for receiving VIPs who wish to visit

All requests for visits to the site or facilities associated with it should be referred to the Local Co-ordination Group. Requests for visits to agency specific locations should be referred to the Local Authority management. Public representatives and other dignitaries may wish to attend the site of the emergency, as well as associated facilities, such as hospitals, to express sympathy on behalf of the public to the injured and bereaved, and to support the emergency response workers.
Visits by dignitaries will usually require security arrangements and liaison with the media. It is important that the organisation of such visits does not distract from the response effort. As a general rule, VIPs should be advised not to visit sites where dangers still exist or where ongoing rescues are in progress.

7.19.3 Arrangements for national / international observers

National and International observers may request to attend the incident. The presence of experts from other regions or jurisdictions, who wish to act as observers at an incident, can greatly enhance the operational debriefings and facilitate the process of learning lessons from the emergency. The Local Co-ordination Group should make arrangements for any such observers.

Section 7.20

Standing-Down the Major Emergency

7.20.1 How the status of the emergency will be stood-down

A decision to stand down the major emergency status of the incident at the site should be taken by the On-Site Co-ordinator, in consultation with the other Controllers of Operations at the site and the Local Co-ordination Group. Where organisations other than the principal response agencies have responded, they should be informed of the decision to stand them down by the Controller of Operations of the agency which mobilised them. Services operating at other locations should be stood down in a similar manner.
The plan may be stood down generally following agreement by the three principal response agencies responding to the emergency or in respect of all or certain local authority services, following consultation with the other principal response agencies.

7.20.2 Operational debriefing and reporting of activity

When the incident has ended, each agency will be obliged to give a debrief to the members of its service that were involved in the emergency. Waterford City & County Council will review the inter-agency co-ordination aspects of the response after every declaration of a major emergency.
A multi-agency debrief will then be held and lessons learned will be incorporated into this Plan. This review should be hosted by the lead agency and involve all services which were part of the response.
Multi-agency debriefs should consider the contribution provided by other, non-emergency service agencies to expand the knowledge and learning process that debriefs should collate. This is notwithstanding the potential conflict of interest that may result in later investigations. This aspect should be considered when inviting agencies other than emergency services to the debrief.

Operational debriefs should identify areas for improvement in procedures, equipment and systems. They should not be forums for criticising the performance of others.
Debriefs should not interfere with or comment on investigations into the incident carried out by investigative or judicial authorities. It is important to realise that such debriefs and related documents would be disclosed to individuals involved in legal proceedings.

Section 8

Agency Specific Elements and Sub-Plans

When planning and preparing for a major emergency it is important that the Major Emergency Plan ties in with existing plans such as Waterford City & County's Flood Response Plan and Severe Weather Plan, *See Appendices. Please refer to 'A Guide to Agency Specific Plan Interoperability' for further details.*

- Plan for the Protection of Public Water Supply
- Drinking Water Incident Management Plan' (DWIRP) (Draft)

Section 9

Plan for Regional Level Co-ordination

9.1 Regional Level Co-ordination

In some situations where a major emergency has been declared and the Major Emergency Plans of the principal response agencies have been activated, it may be appropriate to consider scaling up from a local response to a regional level response. This may occur when:

- the resources available in the local area where the incident has happened do not appear to be sufficient to bring the situation under control in an expeditious and efficient manner; or
- the consequences of the emergency are likely to impact significantly outside of the local area; or
- the incident(s) is spread across more than one Local Authority or Division of An Garda Síochána; or
- the incident occurs at or close to a boundary of several of the principal response agencies.

9.2.1 Decision to Scale up to a Regional Level Response

The decision to scale up from a local to a regional level response will be taken by the chair of the Local Co-ordination Group, in consultation with the chair of the On-Site Co-ordinating Group and the other members of the Local Co-ordination Group. This consultation may occur at a meeting of the Local Co-ordination Group, where such a group is in session or, alternatively, by means of a telephone conference call.
This decision will, by definition, involve specifying those extra principal response agencies which are to be involved in the regional response.

Note: In many Major Emergency situations, neighbouring Garda Divisions, HSE Areas and Council will provide support and resources to the Garda Division, HSE Area and Local Authority, which are primarily involved in the response. Such support is not equivalent to the activation of the Plan for Regional Level Co-ordination and, in fact, will often precede the activation of the regional plan.

9.2.2 Response Region

The areas covered by the principal response agencies which are activated under the Plan for Regional Level Co-ordination will constitute the response region for the emergency.

Note: The response region for a regional level major emergency need not coincide (and in many cases will not coincide) with one of the predetermined Major Emergency Management Regions set out in Appendix F4 of the Framework.

9.2.3 Activation

Once the decision has been taken, the chair of the Local Co-ordination Group will declare that a regional level emergency exists and will activate the Plan for Regional Level Co-ordination by:

- notifying each of the principal response agencies involved that the Plan for Regional Level Co-ordination has been activated;
- requesting that each of the principal response agencies, who has not already activated its MEM Plan, should do so;
- delivering an information message to each principal response agency using the mnemonic METHANE; and
- providing each of the principal response agencies involved with a list of the agencies which are being activated to form the regional response.

9.3.1 Command and Control Arrangements on Site

The command and control arrangements at the site(s) of a regional major emergency will be the same as those for a standard major emergency including:

- three Controllers of Operation[2];
- a lead agency determined in accordance with the Framework; and
- an On-Site Co-ordinating Group
- an On-Site Co-ordinator.

[2]In situations where more than one principal response agency from a particular service is represented at the site, Appendix F7 makes it clear that there will be only one Controller of Operations from that service and the unit from which the Controller of Operations will come should be determined in accordance with the guidance provided in Appendix F7.

9.3.2 The Regional Co-ordination Group

The mobilisation and operation of the Regional Co-ordination Group will be as per the arrangement for Local Co-ordination Groups set out in Section 5.4.5.2 of the Framework.

Regional Co-ordination Group arrangements for
- the mobilisation of other organisations/agencies;
- requesting mutual aid from neighbours;
- requesting national/international assistance where required;
- dealing with multi site or wide area emergencies;
- linkage to national emergency plans;
- links with Government;
- support for chairs by Information Managers, etc; and
- communication arrangements with the site and with other groups

will be as for a Local Co-ordination Group.

9.4 Wide Area Major Emergencies

Some major emergency events (e.g. severe storms, extensive flooding and/or blizzards) may impact over a wide area and, in such a situation, a number of Local Co-ordination Groups may be activated. Where the chair of a Local Co-ordination Group, which has been activated in response to a major emergency, becomes aware that one or more other Local Co-ordination Groups have also been activated, contact should be made with the other chair(s) with a view to considering the establishment of a Regional Co-ordination Centre.

Such a Regional Co-ordination Centre will normally be located at the Local Co-ordination Centre which, in the view of the chairs, is best positioned (in terms of resources, communications and geography) to co-ordinate the activity of the different Local Co-ordination Groups which are active. In such a situation, these Local Co-ordination Groups will continue to act as per standard arrangements and will communicate with the Regional Co-ordination Centre through their chairs.

Note: During a wide area major emergency, each Local Co-ordination Group will be in contact with the lead Government Department (in accordance with Section 5.4.5.5 of the Framework) and, in such a situation, the decision on whether the activities of a number of Local Co-ordination Groups should be co-ordinated via a Regional Co-ordination Centre or via the lead Government Department will be taken in light of the prevailing circumstances.

Section 10

Links with National Emergency Plans

10.1 National Emergency Plans:

Each principal response agency should provide for working with appropriate national bodies and responding to and activating appropriate aspects of their Major Emergency Plan following requests arising from national emergency situations. *Please refer to section 6.3.4.4/ 6.3.4.5 of this document for further details.*

10.1.1 National Emergency Plan for Nuclear Accidents

Details of specific actions to be taken in the event of a local radiological emergency or the activation of the National Emergency Plan for Nuclear Accidents are detailed in the Protocol for Multi-Agency Response to Radiological/ Nuclear Emergencies (in Draft).

10.1.2 National Public Health (Infectious Diseases) Plan

Details of specific actions to be taken in the event of an activation of the National Public Health (Infectious Diseases) Plan are detailed in the Protocol for Multi-Agency Response to Emergencies arising from Infectious Diseases Pandemics (in Draft).

10.1.3 Animal Health Plan

For infectious diseases such as Avian Flu (the Department of Agriculture and Food has an emergency plan designed to contain outbreaks of H5N1 avian influenza in poultry should the disease arrive in this country), Pandemic Flu, Foot and Mouth, there will be a link to the National Plan as outlined by the government. Waterford City & County Council will provide assistance under the command of the lead government department.

10.2 Activation on request from Irish Coast Guard

The Waterford City & County Major Emergency Plan may also be activated by any Principal Response Agency in response to a request from the Irish Coast Guard, following a threatened or actual emergency in the Irish Maritime Search and Rescue Region.

10.3 Activation on request from a Minister of Government

The Major Emergency Plans of the principal response agencies may be activated by an agency in response to a request from a Minister of Government in light of an emergency/crisis situation.

Section 11

Severe Weather Plans

11.1 Sub-Plans for responding to severe weather emergencies

Severe weather emergencies may involve significant threats to infrastructure and support may be required for vulnerable sections of the community. It has been pre-determined that Local Authorities are the lead agency for co-ordinating the response to severe weather events.

Arrangements have also been put in place by Met Éireann to issue public service severe weather warnings to the Local Authorities. The target time for the issuing of a warning is 24 hours before the start of the event, but a warning may be issued up to 48 hours in advance when confidence is high. On Fridays before a holiday period it may be appropriate to issue a preliminary warning or weather watch to Local Authorities.

Not all severe weather events will be major emergencies, but the principles and arrangements for a co-ordinated response to major emergencies should inform all response agencies of severe weather events. Local Authorities should ensure that effective arrangements are in place to receive and respond promptly to public service severe weather warnings issued by Met Éireann.

The Local and/or Regional Co-ordination Centres for Major Emergency Management may be activated to manage the response to a severe weather event, whether a major emergency is declared or not.

11.1.1 Flooding Emergencies

Waterford City & County Council in conjunction with a multi-agency collaboration are in the process of producing a 'Flood Response Plan.'

11.1.2 Severe Weather Conditions (Excluding Flooding Emergencies)

Waterford City & County Council are in the process of producing a 'Emergency Plan for Severe Weather.'

Section 12

Site and Event Specific Arrangements and Plans

12.1 Site and Event Specific Emergency Plans

There are both legislative and procedural arrangements, which require that emergency plans be prepared for specific sites or events (e.g. SEVESO sites, airports, ports, major sports events, etc). Arising from the risk assessment process described in *Section 3*, Waterford City & County Council's Major Emergency Plan has not identified any sites/events where specific plans/ arrangements exist for responding to emergencies.

The response arrangements set out in *Section 7*, will govern the principal response agencies' response to such sites/events, whether a major emergency is declared or not.

12.2 Seveso Sites

Waterford City & County functional area does not have any Seveso Sites.

Section 13

The Recovery Phase

13.1 Support for Individuals and Communities

Although the emergency response stage may have passed, the recovery stage is also important and includes consideration of many strategic issues, which need to be addressed, at both individual principal response agency and inter-agency level. The recovery phase can typically include:

- Assisting the physical and emotional recovery of victims;
- Providing support and services to persons affected by the emergency;
- Clean-up of damaged areas;
- Restoration of infrastructure and public services;
- Supporting the recovery of affected communities;
- Planning and managing community events related to the emergency;
- Investigations/inquiries into the events and/or the response;
- Restoring normal functioning to the principal response agencies; and
- Managing economic consequences.

A structured transition from response to recovery is critical for agencies, both collectively and individually. The recovery stage may be as demanding on the Local Authority resources and staff of the individual agencies as the emergency itself, as work may extend for a considerable time after the incident.

13.1.1 Supporting individuals and communities affected by the emergency

Following an emergency incident, assistance may be required by the victims of the emergency – not only those directly affected, but also family and friends, who may suffer bereavement or anxiety. A major emergency will have a serious effect on a community. The recovery phase should provide support and long term care for individuals involved in the incident and the communities affected by the incident.

It is imperative that the Local Authority restores its critical service to a pre-emergency state as quickly and efficiently as possible.

The services and staff that the Local Authority may be able to provide, are based upon a wide range of skills and resources drawn from its day-to-day operations such as:

- Technical and engineering support
- Building control
- Road services
- Public health and environmental issues
- Provision of reception centres
- Re-housing and accommodation needs
- Transport
- Social services
- Psychosocial support

- Help lines
- Welfare and financial needs

There are specific requirements for each agency in the recovery process. These requirements are:

Local Authority

- Clean-up;
- Rebuilding the community and infrastructure;
- Responding to community welfare needs (e.g. housing); and
- Restoration of services.

An Garda Síochána

- Identification of fatalities;
- Preservation and gathering of evidence;
- Investigation and criminal issues;
- Dealing with survivors;
- Dealing with relatives of the deceased and survivors; and
- Provision of an appropriate response to the immediate public need.

Health Service Executive

- Provision of health care and support for casualties and survivors;
- Support for relatives of casualties and survivors;
- Responding to community welfare needs; and
- Restoration of health services.

13.1.2 Managing of public appeals and external aid

There is a need for the co-ordination of emerging recovery issues, such as managing public appeals and external aid, from the earliest stages of the response phase. For this reason, the arrangements for co-ordination of response should continue to operate during the transition from response stage to recovery stage. At a point when the issues on the agendas of Co-ordination Groups are largely recovery focussed, it may be appropriate to re-title the group as the Local, Regional or National Recovery Co-ordination Group. From the earliest stage, it may be appropriate also for the Local, Regional or National Co-ordination Group to appoint a Recovery Working Group to plan ahead.

It is recommended that Waterford City & County's Local Authority Crisis Management Team will continue to function until the issues arising in the response phase are more appropriately dealt with by the agency's normal management processes. In future such aid will be dispensed through established support networks under the guidance of the Department of Social and Family Affairs or the Health Authority.

13.2 Clean-Up

In the aftermath of an emergency the clean-up operation has been assigned to the Local Authority. The removal of debris and contaminated waste is one of the principal concerns for Waterford City & County Council. In consultation with the EPA and specialist companies the Local Authority will commence clean up of a site as soon as possible but without hindering the investigation process. Careful consideration must be provided for the removal of decontaminated debris to locations that will not affect communities.

13.2.1 Arrangements for clean up of sites / removal of debris / decontamination of emergency sites and the Council's role in this

The holder of waste material or polluting matter shall be responsible for the clean up of the site, the removal of debris and decontamination of the site.

13.3 Restoration of Infrastructure and Services. Specify how restoration of infrastructure and services is to be achieved, and the Council's role in this

The Local Authority must ensure that its critical services are restored as quickly as possible. A Business Continuity Plan has been drawn up to meet these demands.

13.3.1 Procedures and arrangements for monitoring the situation

At a point when the issues on the agendas of Co-ordination Groups are largely recovery focussed, it may be appropriate to re-title the group as the Local, Regional or National Recovery Co-ordination Group. From the earliest stage, it may be appropriate also for the Local, Regional or National Co-ordination Group to appoint a Recovery Working Group to plan ahead. These groups will be responsible for the co-ordination of the recovery phase, managing resources and monitoring the situation until the issues arising are more appropriately dealt with by the normal management processes.

13.3.2 Procedure for liaison with utilities

The utility companies may need to be mobilised in the recovery phase in order to provide essential services such as gas, water and electrical supplies and communications facilities. The IS Section will also have a roll to play in the recovery phase and will need to liaise with utilities in order to bring services back on line, such as communication links etc.

13.3.3 How the order of priorities are to be determined

It is the responsibility of the Local, Regional or National Recovery Co-ordination Group together with the Recovery Working Group to prioritise events during the recovery phase. It should be noted that staff welfare arrangements need to be given priority in the recovery stage of an incident, so that the needs of all staff, both emergency response teams and general staff (including management), are catered for. In addition, the needs of staff that are not directly involved in responding to the incident should also be considered. Those members of staff who continue in their normal work are supporting colleagues in the emergency response and may be taking on additional work in the process. They can be as critical to the organisation's response as those involved at the 'coalface.'

13.3.4 Protective measures against continuing hazards

Following an incident, the holder of waste material or polluting matter shall take all measures to reduce and eliminate any risks from hazards resulting from an incident. The Risk Assessment shall quantify the level of risk associated with the site and shall recommend remedial/protective measures which shall be approved by Waterford City & County Council. The selection of remedial measures is dependent on the results of the quantitative risk assessment that will be site specific. It should be noted that prior to the Risk Assessment it should be assumed that the waste material or polluting matter (i.e. the hazard) should be removed from the site unless it can be demonstrated that an alternative provides greater protection to public health and the environment.

Section 14

Review of the Major Emergency Plan

14.1 Internal Review Process

An internal review of the Major Emergency Plan will be undertaken by Waterford City & County Council on a yearly basis, the review should be held every year on the annual date of implementing the plan and also follow any exercises or incidents. The review should

- Update the roles of individuals that hold key positions
- Update the risk holders within the functional area of Waterford City & County LA
- Update names and numbers of utility companies, private companies etc
- Review current risk assessments and update as required.
- Plan exercises

Please Refer to section 1.8 of this document.

14.2 How the MEP is to be reviewed and amended externally

Waterford City & County Council's appraisal will be reviewed and validated by the South-East Regional Steering Group on Major Emergency Management. This appraisal should also be reviewed and validated by the Department of the Environment, Community and Local Government. Any issues arising from the review should be referred back to Waterford City & County Council for appropriate action. In cases of disagreement between the Local Authority and the Regional Steering Group, the National Steering Group should be consulted and should decide on the issue.

14.2.1 Inter-agency Review Process at the Regional Steering Major Emergency Group

Each principal response agency's Major Emergency Plan should be reviewed and validated annually by the relevant Regional Steering Group on Major Emergency Management. This will include updating and amending the plans as mentioned in *section 14.1* of this document.

Each agency's appraisal should also be reviewed and validated by the relevant parent Department in the case of the Local Authorities and by the national headquarters, in consultation with the parent Department, in the case of Divisions of An Garda Síochána and Health Service Executive Areas, in accordance with the normal appraisal/reporting relationships within that sector. Any issues arising from the review should be referred back to the principal response agency for appropriate action. In cases of disagreement between a principal response agency and a Regional Steering Group, the National Steering Group should be consulted and should decide on the issue.

The regional level report will also be reviewed and validated by the National Steering Group. Any issues arising from the review should be referred back to the Regional Steering Group on Major Emergency Management for appropriate action.

14.2.2 Review of the MEP by the Department of the Environment, Heritage and Local Government

In addition to Waterford City & County Council's Major Emergency Plan being reviewed locally and regionally on an annual basis, it must also be reviewed and validated by the Department of the Environment, Community and Local Government. Any issues arising from the review should be referred back to Waterford City & County Council for appropriate action.

14.3 After every activation, the Major Emergency Plan should be reviewed and reported upon

Once the Major Emergency Plan has been stood down, each of the services and agencies involved in the incident will hold a series of operational hot-debriefs. Initially these will be confined to each particular service, but later a multi-agency cold-debrief will be held, (multi-agency debriefs should consider the contribution provided by other, non-emergency services) and lessons learned will be incorporated into this Plan and other service plans, as appropriate.

14.3.1 How the agency's performance of its functions will be reviewed and reported upon internally

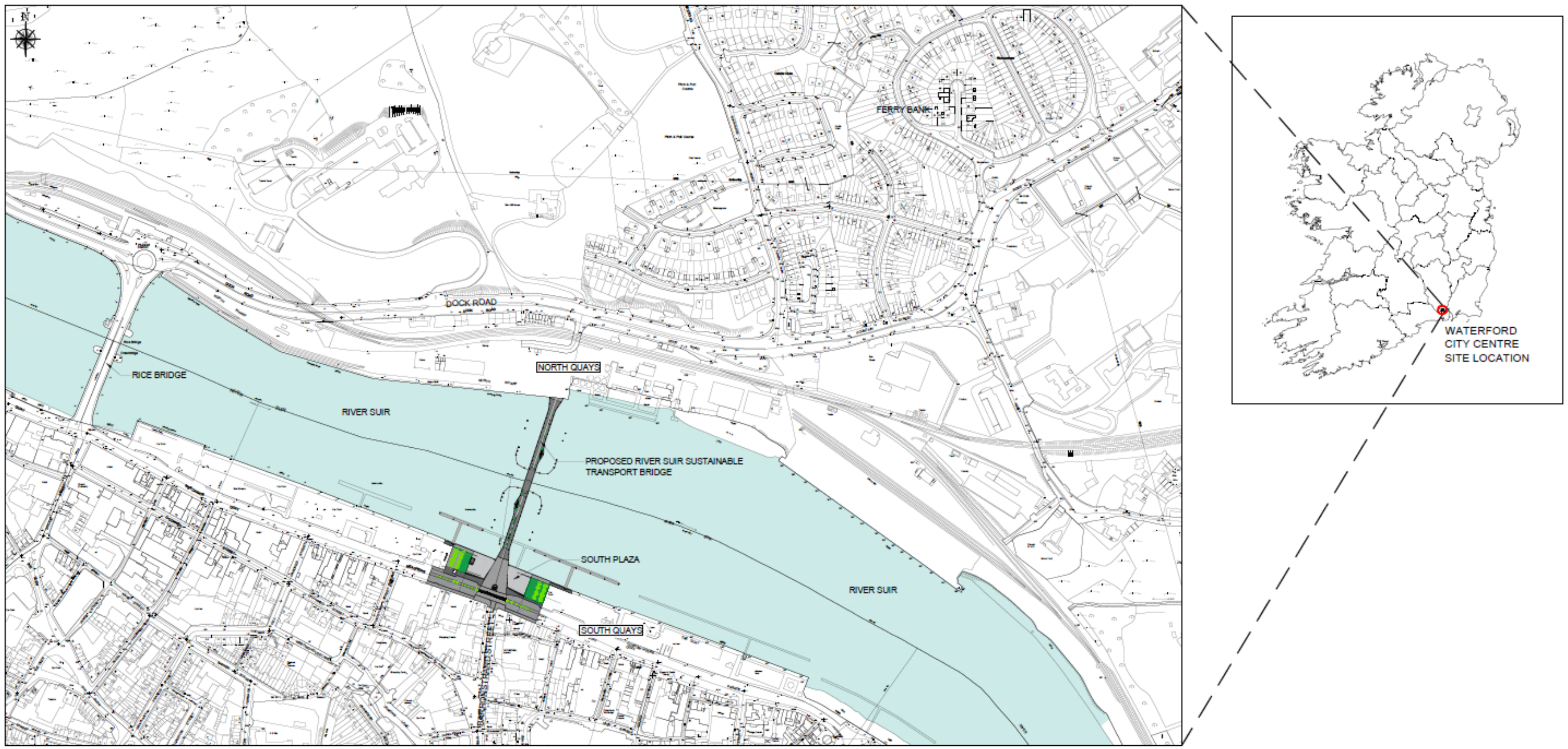
In addition to the review process outlined in the sections above, which takes place annually on a local, regional and national level, the Major Emergency Plan for Waterford City & County and the performance of the Local Authority as a principal response agency will also be reviewed after a major incident within the City/ region or even nationally, when there is learning to be gained. Should any new risks become apparent in the City, the plan will be reviewed to reflect this.

14.3.2 How the co-ordination function will be reviewed and reported upon externally and jointly with other principal response agencies

Multi-agency debriefs should consider the contribution provided by not only each other but also other, non-emergency service agencies. This is notwithstanding the potential conflict of interest that may result in later investigations. This aspect should be considered when inviting agencies other than emergency services to the 'debrief'.
Multi agency reviews must also be conducted on an annual basis between the principal response agencies on both a local and regional level basis. This will include reviewing and reporting on the co-ordination function of the agencies.
Please refer to 'A Guide to Agency Specific Plan Interoperability' for further details.

APPENDIX B

Figure 1



LOCATION PLAN
A1 SCALE 1:2500
A3 SCALE 1:5000

Comhairle Cathrach & Contae Phort Láirge
Waterford City & County Council

No.	Revision	Date	By	Chk'd	App'd
	Stage			Date	App'd
	PRELIMINARY				
	APPROVAL				
	TENDER				
	CONSTRUCTION				

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Project Title	RIVER SUIR SUSTAINABLE TRANSPORT BRIDGE
Drawing Title	LOCATION PLAN ENVIRONMENTAL IMPACT ASSESSMENT REPORT
Drawn:	OB
Job No:	16.169
Drawing No:	Figure 1.1
Rev:	-
Designed:	EP
Checked:	CS
Approved:	TD
Status:	E.I.A.R
Scale (A1):	AS SHOWN
Date:	JUL '18

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

APPENDIX B

Outline Construction Environmental Management Plan

River Suir Sustainable Transport Bridge

Outline Construction Environmental Management Plan

December 2018

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Waterford City and County Council
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River Suir Sustainable Transport Bridge

Outline Construction Environmental Management Plan

TABLE OF CONTENTS

1.0 INTRODUCTION

This document sets out the Outline Construction Environmental Management Plan (OCEMP) for the construction of the River Suir Sustainable Transport Bridge Project ("the Project") on behalf of Waterford City and County Council.

This OCEMP applies to all works associated with the construction of the proposed civil works, marine works and buildings works including the pre-construction site clearance works.

As a contractor has not yet been appointed the Construction Environmental Management Plan (CEMP) has not been formally adopted and further development and commitment to the OCEMP will be undertaken following selection of Contractors and before commencement of site works.

The OCEMP provides the environmental management framework for the appointed Contractors and Sub Contractors as they incorporate the mitigating principles to ensure that the work is carried out with minimal impact on the environment. The construction management staff as well as Contractors and Sub Contractors staff must comply with the requirements and constraints set forth in the OCEMP in developing their CEMP. The key environmental aspects associated with the construction of the River Suir Sustainable Transport Bridge Project, the appropriate mitigation and monitoring controls, are identified in the OCEMP and its supporting documentation.

The implementation of the requirements of the OCEMP will ensure that the construction phase of the project is carried out in accordance with the commitments made by Waterford City and County Council in the planning application process for the development, and as required under the conditions of the planning approval. Once commenced the CEMP is considered a living document that will be updated according to changing circumstances on the project and to reflect current construction activities. The CEMP will be reviewed on an ongoing basis during the construction process and will include information on the review procedures.

1.1 Roles and Responsibilities

The Contractor is responsible to ensure that all members of the Project Team, including sub-contractors comply with the procedures set out in the CEMP. The Contractor will ensure that all persons working on site are provided with sufficient training, supervision and instruction to fulfil this requirement.

The Contractor will ensure that all persons allocated specific environmental responsibilities are notified of their appointment and confirm that their responsibilities are clearly understood. The principal environmental responsibilities for key staff can be identified as follows:

1.1.1 Site Manager

The Site Manager's environmental management responsibilities include but are not limited to:

- preparation and implementation of the CEMP;
- close liaison with the Site Environmental Manager (SEM) to ensure adequate resources are made available for implementation of the CEMP;

- ensuring that the risk assessments for control of noise and environmental risk are prepared and effectively monitored, reviewed and communicated on site; and
- managing the preparation and implementation of method statements; and
- ensuring that the Site Environmental Manager reviews all method statements and that relevant environmental protocols are incorporated and appended.

1.1.2 Site Environmental Manager (SEM)

The responsibilities of the Site Environmental Manager (SEM) include, but are not limited to:

- maintaining environmental records;
- providing guidance for the site team in dealing with environmental matters, including legal and statutory requirements affecting the works;
- reviewing environmental management content of method statements;
- reporting environmental performance to the Site Manager;
- liaison with statutory and non-statutory bodies and third parties with an environmental interest in the scheme; and
- collection and collation of CEEQUAL evidence.

1.1.3 Engineering Staff

The engineering staffs' environmental management responsibilities include but are not limited to:

- reporting any operations and conditions that deviate from the CEMP to the Site Manager;
- taking an active part in site safety and environmental meetings; and
- ensuring awareness of the contents of method statements, plans, supervisors' meetings or any other meetings that concern the environmental management of the site.

1.1.4 Supervisors

The supervisors' environmental management responsibilities include but are not limited to:

- ensuring all personnel affected by a method statement are briefed and fully understand its content. Monitor operatives for compliance, including sub-contract operatives;
- implementation of environmental management activities required by the CEMP and works method statements; and
- ensuring that all inspections are carried out as prescribed in the CEMP.

1.2 Training and Induction

1.2.1 Site Induction

All personnel involved in the proposed bridge development will receive environmental awareness training. The environmental training and awareness procedure will ensure that staff are familiar with the principles of the CEMP, the environmental aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

1.2.2 Specific Training and Awareness Raising

A project specific training plan that identifies the competency requirements for all personnel allocated with environmental responsibilities will be produced by the Contractor. Training will be provided by the Contractor to ensure that all persons working on site have a practical understanding of environmental issues and management requirements prior to commencing activities. A register of completed training is to be kept by the SEM. The Site Manager will ensure that environmental emergency plans are drawn up and the SEM will conduct the necessary training/inductions.

2.0 DESCRIPTION OF THE PROPOSED BRIDGE

2.1. Project Description

The proposed River Suir Sustainable Transport Bridge comprises a 5-span, 8m wide bridge with a segregated space for pedestrians and a shared space for cyclists and an electric shuttle bus service. The bridge location will be approximately in line with Barronstrand Street, in front of the Clock Tower, and will land on the North Quay at the former industrial brownfield site. The sustainable transport bridge crossing point is approximately 550m downriver of Rice Bridge. A paved and landscaped plaza on the South Quay at the Clock Tower is also proposed. Two plant rooms will be required within the vicinity of the north abutment and the south abutment to house the plant and machinery used to operate the twin leaf bascule, whilst noting that the operating room will be in the control tower of the existing Rice Bridge. The plant room / buildings which will be located on the north and south quays will be of the order of 5m x 10m.

2.2. Construction Stage

It is anticipated that the construction of the proposed development will be progressed as a single construction contract with the construction phase lasting approximately 18-24 months.

2.3. Construction Procurement

It is envisaged that the construction of the proposed development will be tendered under a Public Works Contract for Civil Engineering Works Designed by the Employer.

3.0 OUTLINE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

The CEMP will be developed by the contractor to meet the requirements of ISO 14001 and all site works will be undertaken in compliance with the CEMP. The CEMP shall include details of the topics listed below, further information on which is given in the following section.

- Environmental Policy;
- Environmental Aspects Register;
- Project Organisation and Responsibilities;
- Project Communication and Co-ordination;
- Training;
- Operational Control;

- Checking and Corrective Action;
- Environmental Control Measures;
- Complaints Procedure.

The Construction Environmental Management Plan (CEMP) details all the environmental aspects and impacts associated with this contract such as waste management, pollution prevention and protection of flora and fauna with particular emphasis on the Special Area of Conservation (SAC), Special Protection Area (SPA), proposed Natural Heritage Area (pNHA) and Water Quality in the watercourses. The Register of Impacts provides the framework for identifying the potential environmental impacts generated by construction and the associated works. The Environmental Operational Control Procedures and activity specific method statements will detail the working methods necessary for managing and mitigating these impacts, whether it is by prevention or mitigation. Prior to the commencement of construction activities, the Environmental Operational Control Procedures and activity specific method statements will be completed so as to conform to precise site-specific requirements at the bridge location.

3.1 Environmental Policy

The contractor will complete an Environmental Policy with consideration for impacts on the natural and built environment. All project personnel will be accountable for the environmental performance of the project and will be made aware of the Environmental Policy at induction. The environmental policy will consider and make commitments with regard to the protection of Natura 2000, pNHA and NHA sites, emissions to the atmosphere, maintenance of water quality, resource usage energy consumption and waste management.

3.2 Environmental Aspect Register

Once appointed, the Contractor will prepare a register of all sensitive environmental features which have the potential to be affected by the construction works, together with details of commitments and agreements made within the Environmental Impact Statement, the Contract Documentation, Planning conditions imposed by the local authority, and conditions identified by Statutory Authorities with regards mitigation of potential impacts.

The Environmental Aspects Register provides the relevant information for the preparation of construction method statements and will be regularly updated during the works.

The Environmental Aspects Register will consider sensitive environmental features as listed below (please note this list is not exhaustive and will be amended and expanded upon as required by the contractor).

The Environmental Aspects Register will consider sensitive environmental features as listed below (please note this list is not exhaustive and will be amended and expanded upon as required by the contractor).

- Identification off all waterways for the protection against ingress of suspended solids or any pollutant;
- Air emissions;
- Noise emissions;
- Light emissions;

- Waste generation;
- Use hazardous materials;
- Energy usage;
- Water usage;
- Discharge of waste water;
- Traffic generation;
- Terrestrial ecology;
- Aquatic ecology;
- Visual impacts;
- Hydrogeology;
- Archaeology and Cultural Heritage.

3.3 Project Organisation and Responsibilities

The CEMP will define the roles and responsibilities of the project team. The overall responsibility lies with the Project Manager whose responsibility it will be to approve key personnel required for employment on the project. He/She will liaise with the SEM.

The Project Manager will lead the works on site. He/She will be responsible for the management and control of the activities and will have overall responsibility for the implementation of the CEMP. He/She will be assisted by the Site Environmental Manager who will act as his/her deputy.

The Site Environmental Manager will prepare and implement all aspects of the CEMP.

Project Manager

The Project Managers main duties and responsibilities in relation to the CEMP include liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main contractor's project staff.

Site Environmental Manager

The main duties and responsibilities of the Environmental Manger include and are not limited to the following:

- Liaise with the Construction Manager during the finalisation of the CEMP to assign individual duties and responsibilities bearing in mind the overall organisational structure, the nature of the Environmental Commitments and Requirements and the proposed bridge development specific characteristics;
- Ensuring that the CEMP is finalised, implemented and maintained
- Liaising with Waterford City and County Council’s (WCCC’s) Environmental Manager on all Method Statements, any alternations to live documents and any other works to ensure protection of water quality
- Being familiar with the information in the pre-construction surveys, construction Requirements, An Bord Pleanála and Planning Service decision and all relevant Method Statements;
- Being familiar with the contents, environmental commitments and requirements continued within the reference documentation listed in this CEMP;

- Being familiar with the baseline data collated during the compilation of the EIAR;
- Assisting Management in liaising with the Engineers and WCCC and the provision of information on environmental management during the construction of the Project;
- Liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP, to individual members of the main contractor's project staff;
- Overseeing, ensuring coordination and playing a lead role in third party consultations required statutorily, contractually and in order to fulfil best practice requirements;
- Liaising with Management in agreeing site specific Method Statements with Third Parties;
- Ensuring that all relevant woks are undertaken in accordance with the relevant legislation in the Republic of Ireland;
- Bring any legal constraints that may occur during certain tasks to the attention of management;
- Hold copies of all permits and licenses provided by waste contractors;
- Ensuring that any operations or activities that require certificates of registration, waste collection permits, waste permits, waste licences, etc have appropriate authorization;
- Gathering and holding documentation with respect to waste disposal;
- Keeping up to date with changes in environmental practices and legislation and advising staff of such changes and incorporating them into the CEMP;
- Liaising with contactors and consultants prior to works;
- Procuring the services of specialist environmental contactors when required;
- Ensuring that all specialist environmental contactors are legally accredited and proven to be competent;
- Coordinating all the activities of the specialist environmental contractors;
- Ensuring that Environmental Induction Training is carried out on all personnel on site and ensuring that tool box talks include aspects of Environmental Awareness and Training;
- Respond to all environmental incidents in accordance with legislation, the CEMP and company policy/procedures;
- The SEM is responsible for notifying the relevant statutory authority when environmental incidents occur and producing the relevant reports as required;
- Ensuring that all relevant works have (and are being carried out in accordance with) the required permits, licenses, certificates and planning permissions;
- Liaising with the designated licence holders and specific agent defined in the licence with respect to licences granted pursuant to the European Commission (EC) (Natural Habitats) Regulations 1997;
- Carrying out regular documented inspections of the site to ensure that work is being carried out in accordance with the Environmental Control Measures and relevant site-specific Method Statements;
- The SEM should prepare and be in readiness to implement at all times the Emergency Incident Response Plan;

- Responsible for reviewing all environmental monitoring data and ensuring that they all comply with stated guidelines and requirements; and
- Liaising with management in preparing and inspection of site-specific method statements for activities where there is a risk of pollution or adverse effects on the environment.

Design Manager

The main duties and responsibilities of the Design Manger having regard to the implementation of the Construction Environmental Management Plan (CEMP):

- Be familiar with the CEMP and relevant documentation referred to within;
- Participate in Third Party Consultations and liaising with third Parties through the SEM;

Section Managers and Agents

The Section Managers and Agents are responsible for the following:

- Ensuring Forepersons under his/her control adhere to the relevant Environmental Control measures and relevant site-specific Method Statements, etc.
- Ensuring that the procedures agreed during third party consultations are followed;
- Reporting immediately to the Site Environmental Manager any incidents where there has been a breach of agreed environmental management procedures, where there has been a spillage of a potentially environmentally harmful substance, where there has been an unauthorised discharge to ground, water or air, damage to habitat, etc.
- Attending Environmental review Meeting and preparing any relevant documentation as required by Management.

Forepersons

The forepersons on site are responsible for the following:

- Ensuring personnel under his/her control adhere to the relevant environmental control measures and relevant site-specific Method Statements;
- Reporting immediately to the site agents and SEM any incidents where there has been a breach of agreed procedures e.g. spillages and discharges.

All Project Personnel

All project personnel have the following responsibilities:

- Attend environmental training as required;
- Reporting immediately to the Forepersons/Agents or Site Environmental Manager any spillage incidents or observations regarding adverse effects to the Environment.

3.4 Project Communication and Co-ordination

Environmental issues and performance aspects will be communicated to the workforce on a regular basis. Weekly project meetings, which follow a set agenda incorporating Environment, will be held alongside overall management meetings.

All staff and sub-contractors involved in all phases of the project will be encouraged to report environmental issues.

3.5 Training

All employees and subcontractors involved on site will be given a comprehensive induction prior to commencement of the works. This environmental training can be run concurrently with safety awareness training.

Training will include:

- Overview of the Environmental Policy and Environmental Management Plan, goals and objectives;
- Awareness in relation to risk, consequence and methods of avoiding environmental risks as identified within the Register of Aspects and with the planning conditions;
- Awareness of roles and individual environmental responsibilities and environmental constrains to specific jobs;
- Location of and sensitivity of Special Area of Conservations, Special Protection Areas, protected monuments, structures etc.
- Location of habitats and species to be protected during construction, how activities may affect them and methods necessary to avoid impacts.

A record will be kept of a signed register on the project files of all attendee of the environmental induction.

Toolbox talks based on specific activities being carried out will be given to personnel by the nominated project representative. These will be based on specific activities being carried out and will include environmental issues particular to the Project, including the impact on bird populations and water quality namely:

- Oil/Diesel spill prevention and safe refuelling practice;
- Storage of materials including oil/diesels and cement;
- Emergency response processes used to deal with spills;
- Minimising disturbance to wildlife;
- Emergency response to include water pollution hotline to the EPA/WCCC for regulator response. Identification of registered / accredited spill cleanup company for oil etc.; and
- Consideration of importance of containment of vehicle washing, containments of concrete /cement / grout washout etc, bank protection using hessian to prevent excessive scour and mobilisation of suspended solids, maintenance of vegetation corridors etc.

3.6 Operational Control

Site works will be checked against the CEMP requirements. Any mitigation measures that have been agreed with the Statutory Authorities, or are part of planning conditions, will be put into place prior to the undertaking of the works for which they are required and all relevant staff will be briefed accordingly.

Method statements that are prepared for the works will be reviewed / approved by the Client Project Manager and were necessary the relevant Environmental Specialist. All method statements for works in, near or liable to impact on a waterway must have prior agreement with IFI and NPWS.

A Quality Management System (QMS) will also be put into operation for the project. Document control will be in accordance with this QMS and copies of all audits, consents, licences, etc will be marinated by the Site Environmental Manager and his team and kept on site for review at any time.

3.7 Checking and Corrective Action

Daily inspections of the site and the works will be undertaken to minimise the risk of environmental damage and to ensure compliance with the CEMP. Any environmental incidents are to be reported immediately to the Site Foreman. The Site Environmental Manager will undertake periodic inspections and complete an assessment of the project's environmental performance with regard to the relevant standards/legislation and the contents of the CEMP. Following these inspections, the Site Environmental Manager will produce a report detailing the findings which will be provided to the Client Project Manager and reviewed at the monthly project meeting.

3.8 Environmental Control Measures

Licensing requirements will be in place and Specific procedures to manage the key environmental aspects of the project will be developed by the contractor prior to work commencing.

3.9 Complaints Procedure

A liaison officer will be available to allow for member of the pubic or interested parties to make complaints about the construction works. The CEMP will contain details of the complaints procedures and a monitoring system will be implemented to ensure that any complaints are addressed and satisfactory outcome is achieved for all parties.

3.10 Compliance with Project Consents

If planning permission is granted for the proposed development, the entire contents of the planning consent as well as the foreshore licence/lease, and other consents and conditions, shall be appended as received.

4.0 SUMMARY

This Outline CEMP is indicative only, however, it is expected that the final CEMP to be prepared by the Contractor will incorporate the items outlined above and ensure that all requirements identified as part of the planning consents will be included in the CEMP.

APPENDIX C

Outline Construction and Demolition Waste Management Plan

River Suir Sustainable Transport Bridge

Outline Construction and Demolition Waste Management Plan

December 2018

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River Suir Sustainable Transport Bridge

Outline Construction and Demolition Waste Management Plan

TABLE OF CONTENTS

1.0 INTRODUCTION

This outline Construction and Demolition Waste Management Plan (CDWMP) has been developed to ensure that waste arising on-site during the construction and demolition phase of the River Suir Sustainable Transport Bridge will be managed and disposed of in a way that ensures the provisions of the Waste Management Acts, 1996-2011 and associated Regulations (1996-2011) are complied with and to ensure that optimum levels of reduction, re-use and recycling are achieved.

This outline CDWMP has been prepared for the provision of waste management for the construction phase of the River Suir Sustainable Transport Bridge, taking into account the many guidance documents on the management and minimisation of construction and demolition waste, including:

- DEHLG (2006) *Best Practice Guidelines on the Preparation of Waste Management Plans for construction and Demolition Projects*. Department of Environment, Heritage and Local Government, Dublin;
- Provisions of the Waste Management Acts, 1996-2011 and associated Regulations;
- Construction Industry Research and Information Association (CIRIA) document 133 Waste Minimisation in Construction;
- TII (2014) *Guidelines for the Management of Waste from National Road Construction Projects*. Transport Infrastructure Ireland, Dublin; and,
- National Construction & Demolition Waste Council (NCDWC) 2006 *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects.*

This plan is intended to be a working document and has been prepared to inform the Construction and Demolition Waste Management Plan which, in turn, will form an integral part of the Environmental Operating Plan (EOP) for the proposed development.

This document is preliminary in nature as it has been prepared at a stage when quantities are based on the design developed to a sufficient level of detail to inform the environmental impacts to be assessed in the Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS). However, changes may occur during detailed design stages which may alter the volumes of waste.

All materials used during construction will be imported. Minimal quantities of soils will be excavated during construction.

Prior to the commencement of construction works, a Waste Management Co-ordinator (WMC) (who may also be the Site Environmental Manager) will be appointed by the Contractor to assume responsibility for the further development of the CDWMP and the management and treatment of all waste materials created during the construction of the River Suir Sustainable Transport Bridge.

The Contractor's CDWMP must contain (but not be limited to) the following measures:

- Details of waste storage (e.g. skips, bins, containers) to be provided for different waste and collection times;
- Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility;

- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of, where necessary;
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner; and
- Details of locations.

Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects were published in 2006 by the National Construction & Demolition Waste Council (NCDWC). These Guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion. These Guidelines have been followed in the preparation of this report.

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Project Description

The proposed River Suir Sustainable Transport Bridge comprises a 5-span, 8m wide bridge with a segregated space for pedestrians and a shared space for cyclists and an electric shuttle bus service. The bridge location will be approximately in line with Barronstrand Street, in front of the Clock Tower, and will land on the North Quay at the former industrial brownfield site. The sustainable transport bridge crossing point is approximately 550m downriver of Rice Bridge. A paved and landscaped plaza on the South Quay at the Clock Tower is also proposed. Two plant rooms will be required within the vicinity of the north abutment and the south abutment to house the plant and machinery used to operate the twin leaf bascule, whilst noting that the operating room will be in the control tower of the existing Rice Bridge. The plant room / buildings which will be located on the north and south quays will be of the order of 5m x 10m.

2.2 Construction Stage

It is anticipated that the construction of the proposed development will be progressed as a single construction contract with the construction phase lasting approximately 18-24 months.

2.3 Construction Procurement

It is envisaged that the construction of the proposed development will be tendered under either a Public Works Contract for Civil Engineering Works Designed by the Employer or a Public Works Contract for Civil Engineering Works Designed by the Contractor.

3.0 WASTE MANAGEMENT STRAGETY

3.1 Scope

The Contractor will develop a CDWMP that will detail:

- Licensing of Waste Disposal;
- Site clearance;

- Excavations and disposal of materials;
- Measures to protect water quality;
- Importation, stockpiling and placing of fill;
- Management of drainage works to ensure no pollution of the River Suir;
- Construction vehicle management; and,
- Dust and noise abatement measures.

3.2 Waste and Recycling Management

The management of construction and demolition waste will reflect the waste management hierarchy, with waste prevention and minimisation being the first priority, followed by reuse and recycling. During site clearance and construction works, there are numerous opportunities for the beneficial reuse and recycling of materials. The subsequent use of recycled materials in reconstruction works also reduces the quantities of waste which ultimately needs to be consigned to landfill sites.

The Contractor will develop and implement a plan and manage all waste with a goal of achieving the waste hierarchy in accordance with the relevant statutory provisions as shown in Figure 3.1.

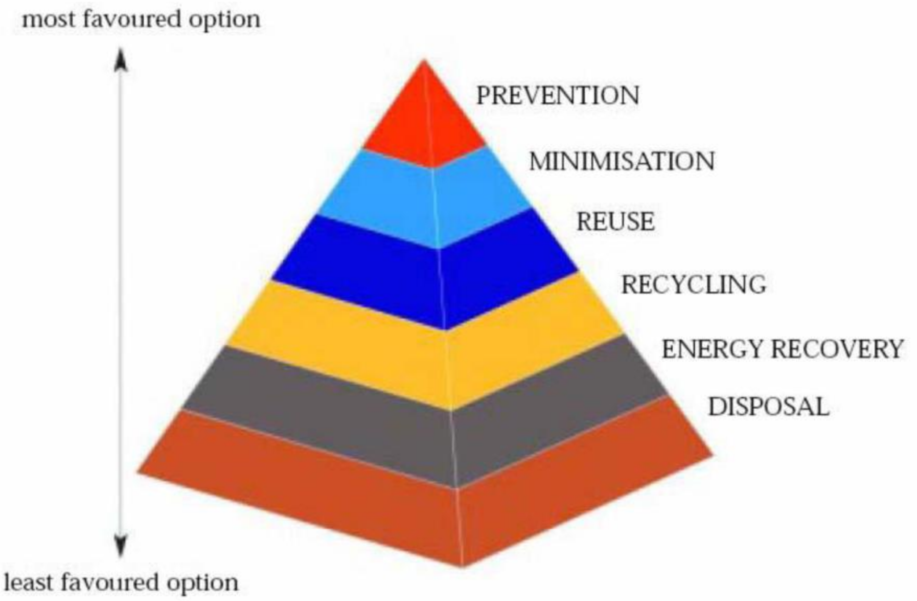


Figure 3.1 The Waste Management Hierarchy [DEHLG (1998) *Changing Our Ways*. Department of the Environment, Heritage and Local Government, Dublin]

Source Segregation

Wastes generated on the construction site will be identified and segregated according to their respective categories, as described by the European Waste Catalogue (EWC). Where possible, metal, timber, glass and other recyclable material will be segregated and removed off-site to a permitted/licensed facility for recycling.

In order to achieve this, designated waste storage areas will be created at the construction compound or other suitable locations for the storage of segregated wastes prior to transport for recovery/disposal at suitably licensed/permitted facilities. Suitably sized containers for each waste stream will be provided within the waste storage area and will be supervised by the WMC, who will be appointed by the Contractor. This will be the person responsible for the management of waste during the construction of the River Suir Sustainable Transport Bridge. The number and sizing of containers will be agreed with Waste Contractors in advance of construction works commencing. Source segregation of waste will result in cost savings to the project as well as providing an environmentally sound route for the management of all construction and demolition wastes.

Re-use

Possibilities for re-use of clean, non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. During Ground Investigations (GI), samples were taken from exploratory holes and were tested at the Chemtest Accredited Laboratory in the UK. All samples have been classified as falling within either the non-hazardous or inert limits. Some localised elevated levels of hydrocarbons (PAH) and heavy metals (Arsenic) were recorded, specifically in locations along the River Suir riverbed Where excavated material is not to be reused within the works, the Contractor will endeavour to send material for recovery or recycling so far as is reasonably practicable. The Contractor will ensure that, if required, any off-site interim storage facilities for excavated material have the appropriate waste licences or waste facility permits in place.

Material Management

In order to prevent and minimise the generation of waste, the Contractor will be required to ensure that raw materials are ordered so that the timing of delivery, the quantity delivered and the storage is not conducive to the creation of unnecessary waste. The Contractor, in conjunction with the material suppliers, will be required to develop a programme showing the estimated delivery dates and quantities for each specific material associated with each element of construction and demolition works. Following a "just-in-time" approach improves cash flow, better utilises storage space, reduces risk of environmental pollution events and reduces potential loss to theft and accidental damage as well as making the site safer.

It is essential that the planning, construction and demolition works are undertaken in close collaboration with waste management contractors, in order to determine the best techniques for managing waste and to ensure a high level of recovery of materials for recycling. The Contractor will be required to continuously seek to improve the waste management process on-site during all stages of construction and maximise opportunities for re-use and recycling where they exist. For example, in relation to waste packaging, the Contractor will seek to negotiate take-back of as much packaging waste as possible at source to ensure maximum recycling. The CDWMP will be included as an agenda item at the weekly construction meetings. In addition, the plan will be communicated to the whole team (including the Client) at the monthly meetings. This will include any updates to earlier versions of the document.

Waste Auditing

The Contractor will record the quantity (in tonnes) and types of waste and materials leaving the site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials from the construction phase are delivered will be recorded along with the quantity of waste (in tonnes) delivered to each facility. Records will show all material recovered and disposed of.

The waste management strategy for the project will follow the accepted waste hierarchy and the Contract will implement the following types of measures to reduce waste and maximize opportunities for recycling:

- Wherever possible, materials for construction activities will be ordered as to require the minimum possible storage time;
- Materials will be ordered, where possible, in sizes to prevent wastage;
- Appointment of a WMC, who will be responsible for handling, storage and delivery of materials to the proposed development;
- Ensure that stored material is protected from damage from plant and environmental factors such as rain and wind;
- Secure storage areas to prevent unauthorised access;
- Establish a waste management compound to handle incoming waste from construction activities – this should facilitate the segregation of key waste streams to maximise the opportunity to re-use, recycle and return wastes generated on-site;
- Provide a separate secured area for dealing with hazardous waste; and,
- Provide separate facilities for the storage of fuels and chemicals.

3.3 Waste and Recycling Targets

The Contractor's CDWMP, waste handling and proposed construction methods should endeavour to achieve the following targets

- The re-use of all earthworks materials on site where possible;
- 100% recycling of surplus reinforcement and other metals, where possible; and,
- No contamination of skips.

3.4 Waste and Recycling Opportunities

The Contractor will seek opportunities, wherever possible, to reduce the amount of waste generated on site and maximize the potential for recycling materials in accordance with the waste hierarchy through the following:

- Storing materials in designated areas and separate from wastes to minimise damage;
- Returning packaging to the producer where possible;
- Segregating construction and demolition wastes into reusable, recyclable and non-recyclable materials;
- Reusing and recycling materials on site during construction where practicable;
- Recycling other recyclable materials through appropriately permitted/licensed contractors and facilities; and,
- Disposing of non-recyclable wastes to licensed landfills.

4.0 WASTE DISPOSAL LICENSING

4.1 Licensing Requirements

Under the Waste Management (Collection Permit) (amended) Regulations, 2016, a waste collection permit for appropriate EWC Code(s) and designations is required by a waste haulier to transport waste from one site to another. Compliance with the Waste Management (Shipments of Hazardous Waste in Ireland exclusively) Regulation, 2011 is also required for the transportation of hazardous waste by road. The export of waste from Ireland is subject to the requirements of the Waste Management (Shipment of Waste) Regulations, 2007. The Contractor will ensure that the transport and movement of all waste is carried out in compliance with these requirements.

Waste may only be treated or disposed of at facilities that are licensed to carry out that specific activity, *e.g*. chemical treatment, landfill or incineration, for a specific waste type. Records of all waste movements and associated documentation will also be held on-site. Generally, operators of waste management sites will facilitate a site visit and inspection of documentation if deemed necessary. Prior to any on-site recovery process, including the operation of mobile plant, an operator must apply to the governing local authority for a waste facility permit under the Waste Management (Facility Permit and Registration) Regulations, 2007. It is planned that waste activities at the site will comprise of source segregation, storage and collection and, therefore, it is highly unlikely that any waste licensable or waste permissible activity will be undertaken.

4.2 Exclusion from Legislation

The Directive on Waste contains a number of exclusions which make clear that certain materials are not subject to its requirements. A key exclusion affecting construction projects such as this development is set down in Article 2(1)(c). This states that the requirements of the EU legislation do not apply to:

> *"uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated"*

This provision is repeated in the Waste Management Acts, as amended by the European Communities (Waste Directive) Regulations, 2011 (SI No. 126/2011). Should materials generated by construction activities fall within this provision, they are not then subject to the other requirements of the EU or national waste legislation. This means that, for example, such materials are not defined as "waste", do not need to be handled by duly authorised waste collectors and do not need to pass to disposal or recovery facilities that are subject to waste licences or other equivalent form of statutory authorisation. In addition, the requirements of the Waste Hierarchy do not apply.

5.0 PROPOSED CONSTRUCTION METHODOLOGY AND MATERIAL USAGE

5.1 Site Preparation

The construction of the River Suir Sustainable Transport Bridge will require site clearance as part of the development. Site preparation will include certain diversion works of services and utilities, such as public lighting, power services, watermains, rising main, storm water, electricity, telecommunications, gas mains and traffic light services. Due to the nature of some of the diversions, a number of these service diversions will only be possible during the main construction works.

The Contractor's CDWMP will take the following into account:

- The extent of the areas to be cleared and the potential types and volumes of arisings;
- The location of any structures to be demolished;
- Statutory requirements; and
- Specific environmental requirements and seasonal requirements, e.g. in respect of Shad, Salmon and Lamprey.

5.2 Site Offices, Construction Compounds and Security

A construction compound will be required in the vicinity of the proposed development and is proposed and assessed as being located on the South Quay. The location, size and suitability of the compound will ultimately be at the discretion of the contractor once it is located within the project boundary and site access is approved by the Local Authority. For the purpose of the Environmental Impact Assessment Report (EIAR), it has been anticipated that the construction compound will be located on the South Quay. The location and layout of the construction compound selected by the contractor will however have to incorporate the protection and mitigation measures outlined in the EIAR and conform to the requirements outlined in the Natura Impact Statement (NIS) and planning conditions.

The compound will include stores, offices, material storage areas, plant storage and parking for site and staff vehicles. This site is proposed to remain in place for the duration of the contract but may be scaled up or down during particular activities on site.

During the construction phase, the contractor will be required to erect opaque hoarding of a minimum 2.0m in height around the site compound and works area on the South Quays. The hoarding shall be a high gloss printed finish with information and graphics about the project or as agreed with Waterford City and County Council. The precise hoarding type shall be agreed with Waterford City and County Council prior to works commencing.

The storage of fuels, other hydrocarbons and other chemicals within the construction compounds will not be permitted within 10m of the River Suir. All fuel storage areas will be bunded to 110% of storage capacity to prevent spills and provide sufficient additional capacity in the event of rainfall occurring simultaneously. The compounds will also have appropriate levels of security to limit potential vandalism, theft and unauthorised access within the compounds.

Following completion of construction, the compound will be cleared, landscaped and paved. Temporary buildings and containers, parking areas and waste material such as rubble, aggregates and unused construction materials will not be permitted to remain exposed on these sites and will need to be removed and disposed of appropriately.

5.3 Material Quantities

All materials used during construction will be imported. Minimal quantities of soils will be excavated during construction.

5.4 General Construction and Demolition Works

Quantities of general construction and demolition wastes are made up of waste such as wood, packaging, metals, plastics, bricks, blocks, canteen waste, some hazardous waste, e.g. oils, paints and adhesives. Site clearance and residual waste will be generated during the construction phase, primarily from the construction of the proposed development. While it is difficult at this stage to predict precise volumes of these wastes expected from the proposed development, the EPA has produced figures for the construction and demolition waste recorded in the National Waste Database. This includes a percentage breakdown of each waste type in the construction and demolition stream (Table 5.2). A more detailed estimate of the anticipated quantities of these materials will be provided in the detailed CDWMP following appointment of the Contractor at construction stage.

Table 5.2 shows the breakdown of the construction and demolition waste types (from EPA data) produced on a typical site.

Table 5.2: Waste Materials Generated on a Typical Irish Construction Site

Waste Type	Proportion (%)
Soil and stones	51
Concrete, bricks, tiles, ceramic, plasterboard	39
Asphalt, tar and tar products	2
Metals	2
Other	6
Total Waste	**100**

An overview of the methods to manage the primary waste streams expected is presented below. The main types of construction waste produced will be:

Excavated material

Where short-term temporary storage is unavoidable, the method of storage of material will be key to its potential use as certain types of materials are likely to degrade if left uncovered in wet weather due to its low plasticity and silty nature.

Concrete

Waste concrete is likely to arise during the construction phase of the River Suir Sustainable Transport Bridge. It is proposed that waste concrete generated will be returned to the supplier for re-use. For every tonne of concrete waste that is recycled for aggregate in new concrete, significant savings are made in energy and carbon dioxide emissions. It also saves money by avoiding disposal costs, which continue to increase. Residual concrete waste will be source segregated and stored in designated containers at the waste storage area for subsequent separation and recovery at a remote facility.

Metals

Metal waste has a significant scrap value. Although it is now common practice for sites to segregate metals for reuse and recycling, there are still sites where metal is thrown away with general rubbish. One of the primary sources of metal waste is steel reinforcement. Wastage of steel reinforcement will be reduced by ordering made to measure steel from the manufacturer and detailed scheduling of all reinforced concrete structural elements.

Skip hire companies may provide free skips for the storage of scrap metal on sites and this will be investigated prior to construction commencing. When metal storage containers are full they will be removed by the waste storage contractor and sent to a metals recycling facility.

Timber

Timber waste will be stored separately as it is readily contaminated by other wastes and if it is allowed to rot will reduce the recyclability of other stored wastes. Any pallets will be returned to the supplier for re-use. Off-cuts and trimmings will be used in formwork where possible. A container for waste wood will be covered where possible and will be placed in the waste storage area. The waste wood will be collected by a waste contractor who will forward it to a wood recycling facility for chipping.

Treatment of timber with chemicals and the overuse of nails will be minimised and avoided as this will make it difficult to reuse/recycle the timber afterwards. The utilisation of reclaimed timber products will also be investigated.

Packaging and Plastic

Packaging waste can become a major problem on construction sites. Double handling will be avoided by segregating packaging wastes immediately after unwrapping. Many suppliers are now prepared to collect their own packaging for recycling, and this will also be investigated prior to works commencing. It is intended that, where possible, materials with recycled packaging will be purchased. Waste packaging will be segregated and stored in separate containers, preferably covered, in the waste storage area for collection by the waste management contractor and distribution to packaging recycling facilities.

Blocks, Bricks and Tiles

The careful storage of these raw materials will significantly reduce the volume of these wastes arising on site. The most likely wastes produced will be off-cuts, trimmings and waste arising from breakages. Every effort will be made to use broken bricks and off-cuts.

Hazardous Wastes

Prior to removal from the site, any hazardous waste identified will undergo a comprehensive waste assessment and classification by a suitably qualified person in accordance with the European Waste Catalogue and Hazardous Waste List. It should be noted that if non-hazardous waste becomes contaminated with hazardous waste the entire load will be considered hazardous. It is, therefore, critical to ensure that waste segregation areas are provided and are used properly to separate out hazardous, non-hazardous and inert waste arising. Hazardous wastes will be identified, removed and kept separate from other construction and demolition waste materials in order to avoid cross-contamination. Specific method statements detailing the necessary mitigation measures required during excavation, handling transportation and disposal of hazardous wastes encountered on the site will be prepared as required.

The likely disposal/treatment options for any hazardous wastes available to the Contractor will depend on the nature of the hazardous material and the concentration of parameters of concern. The costs associated with treatment and disposal will similarly vary depending on the concentration of parameters of concern and on the tonnage involved. There are several operators/facilities in operation within Ireland that could potentially accept the contaminated material depending upon the results of the Waste Acceptance Criteria testing or assist in the export of the material abroad for special treatment where required. Full details of the disposal route for hazardous wastes will be provided in the detailed CDWMP following the appointment of the contract and completion of the further investigations required.

Hazardous Liquids (Oils, Paints, Chemicals)

Hazardous liquid waste arising from the construction process will require careful handling. Oils, paints, bitumen, adhesives and chemicals will be kept in a separate contained storage area which will be locked when not in use. Hazardous liquids will be stored at least 10m from the River Suir. Lids will be kept on containers in order to avoid spillage or waste by evaporation. Waste oils, paints and chemicals, including the containers, will require careful handling and disposal. These will be stored in a containment tray with a capacity to contain 110% of the volume of the largest container.

Fuels and chemical will be stored in double-skinned containers or within a bund, i.e. an impervious structure with the capacity to contain 110% of the volume of the largest tank stored within it. All containers will be carefully labelled.

Food Wastes

Site staff generate food waste and packaging waste. Designated receptacles will be provided to allow for the segregation and storage of individual waste streams. These will include receptacles for food waste, *e.g*. brown bin for waste foods and peelings, dry recyclables, *e.g*. green bin for packaging, plastics, metals, wood, paper, cardboard and tetrapack, and residual bin, *e.g*. black bin for mixed food and packaging waste. Separate receptacles for the recyclable fractions may be provided such as plastics, metals, glass and this will be designed and detailed by the WMC in consultation with the selected waste management contractor.

Other Wastes (Residual)

Waste material other than those outlined above can constitute a significant proportion of the total waste generated by a construction site. This waste is normally made up of residual, non-recyclable waste such as soiled paper, cloth, cardboard or plastics, as well as food waste and general waste found on the site, including plastic bottles, bags, cans *etc*. Given the heterogeneous nature of this material, it is most important that residual waste is kept separate from the other waste streams to avoid contamination. This material will be stored in a dedicated container in the waste storage area. Container size and collection frequency will be assessed with waste management contractors as works proceed. All residual wastes will be dispatched to a suitably licensed facility for disposal. Other construction and demolition waste material will be collected in receptacles with mixed construction and demolition waste materials for subsequent separation and disposal at a segregation facility.

6.0 ASSIGNMENT OF RESPONSIBILITIES

A WMC will be appointed who will have overall responsibility for waste management on the site. The Employer (Waterford City and County Council) will receive summaries of any audit reports, which will be completed within three months of the end of each calendar year. The effectiveness and accuracy of the documentation may also be monitored on a regular basis via routine site visits. Following appointment of the preferred Contractor, the CDWMP will be updated in accordance with the final design and copies of the plan will be distributed to the Employer, the Site Manager and the site sub-contractors. The WMC appointed by the Contractor will be appropriately trained and experienced in all aspects of waste management. In addition he/she and the site crew must be in a position to:

- Distinguish reusable materials from material suitable for recycling;
- Ensure maximum segregation at source;

- Co-operate with site manager on best locations for stockpiling reusable material;
- Separate material or recovery; and,
- Identify and liaise with operators of recovery outlets.

The WMC will be responsible for educating all site staff, sub-contractors and suppliers about the available alternative to conventional waste disposal. Training will also be given to all site staff in materials management on sites. The WMC will continually identify waste minimisation actions on sites and this will be updated in the plan.

7.0 TRAINING

Copies of the CDWMP will be made available to all personnel on-site. All site personnel and sub-contractors will be instructed about the objectives of the plan and informed of the responsibilities that fall upon them as a consequence of its provisions. This is traditionally carried out during the induction process for new staff members. Where source segregation and material re-use techniques apply, each member of staff will be given instructions on how to comply with the CDWMP. Site notices will be designed to reinforce the key messages within the plan and will be displayed prominently for the benefit of staff.

8.0 WASTE RECORDS

When establishing the system for managing the details of all arisings, movement and treatment of construction and demolition waste in the CDWMP, the use of electronic tools should be considered to provide for convenient recording of information in a useful format such as "Smart – waste".

The Contractor will be required to arrange for full details of all arisings, movements and construction and demolition waste to be recorded during all stages of the proposed development. Each consignment of construction and demolition waste removed from the site will be documented in the form of a Waste Movement Record form, which will ensure full traceability of the material to its final destination. Separate record forms will be completed in respect to each waste transfer that takes place. The Contractor will also receive printed documents/records from waste disposal companies employed, quantifying the exact amount of waste material removed from site. The sheet from the disposal company also identifies how much material went to landfill and how much went for recycling. All such records will be retained in a designated location and made available for auditing of the CDWMP.

9.0 SUMMARY OF THE CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

Waste will inevitably be generated during the construction and demolition phase of the River Suir Sustainable Transport Bridge. It is intended that all steel and concrete will be imported for use within the project area. At this stage it is anticipated that there will be no excavated material for re-use on-site.

Other than spoil material from excavations, waste arisings during the construction phase will be minimised by the purchasing manager, who will time the ordering of materials so as to reduce the likelihood of over-purchase or damage during storage. Construction and demolition waste fractions will be segregated and stored on-site in designated areas or containers in the waste storage area prior to transport by licensed hauliers to facilities for segregation recycling and disposal.

A WMC will be appointed to ensure that the CDWMP is followed. Training will be given to all staff so that they are aware of the CDWMP and know their responsibilities.

Records will be kept to trace the inputs and outputs of the construction works at the site and this should allow the Employer to make informed decisions regarding waste management in the future. These records will be made available to the relevant local authorities and the EPA should it be required.

The design and implementation of the detailed CDWMP, in conjunction with the EOP for the River Suir Sustainable Transport Bridge, will provide for the optimum planning/management and handling of waste generated by the project and will ensure that there will be no worse than a neutral or imperceptible impact from waste management practices during construction.

The contractor appointed to undertake the construction of the River Suir Sustainable Transport Bridge will develop their own CDWMP based on their detailed plans, the requirements of this outline plan, the requirements of the EIAR, the requirements of the NIS and any commitments given as part of the project approval process and the Employer's requirements and specifications for executing the River Suir Sustainable Transport Bridge.

Chapter 5
Traffic and Transport

Chapter 5 Traffic and Transportation

5.1 Introduction

This chapter of the Environmental Impact Assessment Report considers and assesses the potential traffic and transportation impacts associated with the construction and operational phases of the proposed sustainable transport bridge, incorporating pedestrian and cycle facilities, along with an electric shuttle bus service; that will connect the Waterford North Quays Strategic Development Zone (SDZ) site to Meagher's Quay on the southern side of the River Suir.

5.2 Planning Policy

Waterford City Development Plan 2013 – 2019

The Waterford City Development Plan 2013- 2019 sets out an overall strategy for the proper planning and sustainable development of the functional area of Waterford City.

Some of the key relevant transport policies and objectives to be considered as part of the development options include the following:

- "To expand the network to connect the city centre to any proposed North Quay development with a foot/cycle bridge" (OBJ 6.2.2, *Pg. 87*)
- "To provide an appropriately designed and constructed pedestrian river crossing located in the vicinity of the Clock Tower to provide accessibility to the North Quays and facilitate future development" (OBJ 6.2.7, *Pg. 90*)

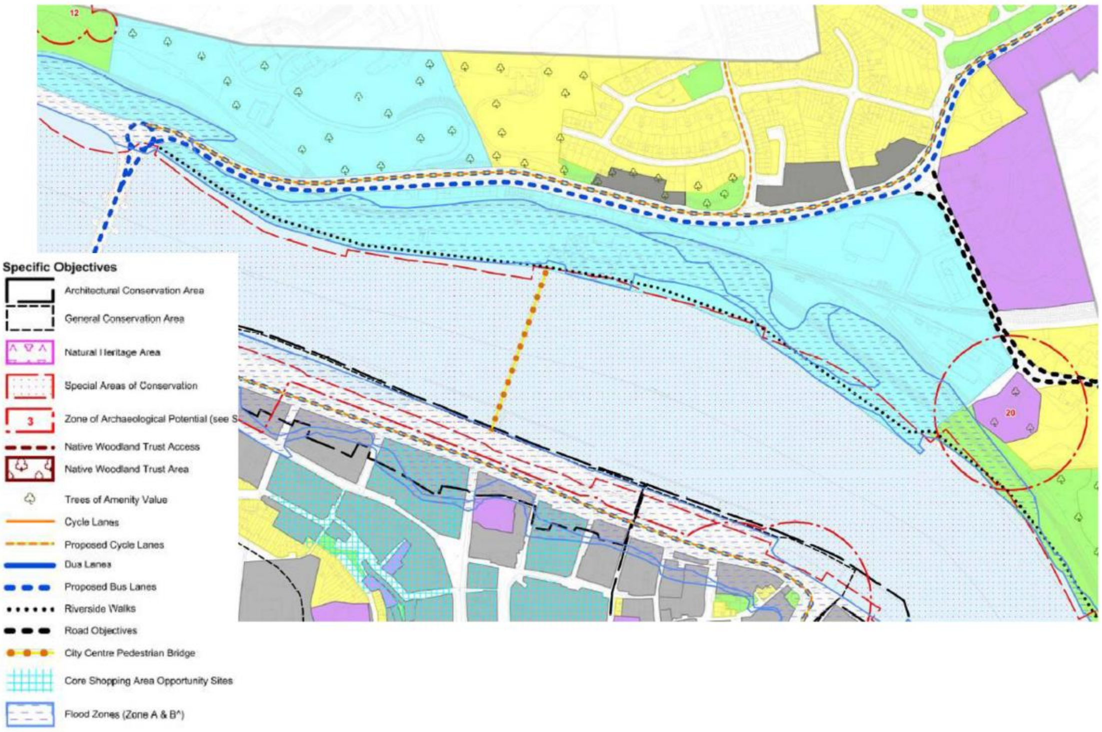


Plate 5.1 Waterford City Development Plan 2013 – 2019, Map B – City Centre Extract

As part of the document, a series of policies are outlined which the council hope to meet over the lifetime of the plan. Some relevant policies identified are as follows:

- *POL 1.1.6:* To facilitate provision of a good quality public transport system and a choice of transport modes within the City in accordance with the existing Green Routes Strategy and Smarter Travel National Guidance. To provide good connectivity to and within the City and to ensure ease of mobility/access from neighbourhoods to the City Centre, and between neighbourhoods.
- *POL 1.1.12:* To develop the City generally in accordance with the integrated land use and transportation framework set out in the Waterford Planning, Land Use and Transportation Strategy (PLUTS).

Chapter 6 of the Development Plan describes the proposed improvements to the transport network in the city, citing one of the key issues currently as high congestion levels on the road network. According to the Plan, *"the most direct method of tackling congestion is by providing alternative transport choices to encourage a modal shift to public transport and non-car modes, while also focussing local transport policy on developing improved public transport services and other sustainable modes".*

Several of the key transportation objectives outlined in the plan relate to the proposed sustainable bridge, and the impact it would have on the surrounding area. These specific objectives are presented in Plate 5.1. Such objectives are listed below:

- *OBJ 6.2.1:* To provide a citywide cycle network to link all areas of the city to each other via main routes. Existing and proposed extension of the City's cycle network is also outlined on the zoning objectives map . The proposed network is both radial and orbital, with some elements located off street in amenity areas.
- OBJ *6.2.4:* To provide cycle and walking networks between neighbourhood areas, further negating the need for car-based journeys.
- OBJ *6.2.7:* To provide an appropriately designed and constructed pedestrian river crossing located in the vicinity of the Clock Tower to provide accessibility to the North Quays and facilitate future development.

There are also two further river crossings mentioned in the plan, both downstream of the site of the proposed sustainable bridge. Their objectives are as follows:

- OBJ *6.2.6:* Extension of the Outer Ring Road with an appropriately designed and constructed downstream river crossing to complete the orbital road network and provide a distributor route around the city. Linking development areas to the north of the Suir to those on the south and providing traffic relief for the city centre and a further alternative crossing point of the river. PLUTS identified the optimal location for the river crossing in the Maypark area, but this will be subject to further feasibility and environmental assessment.
- OBJ *6.2.8:* Investigate the feasibility of provision of an open span bridge facilitating a light public transport system near to Reginald's Tower linking up with future development on the North Quays. The provision of such a looped transport system in the City is desirable. There is an option for such a looped transport system also being facilitated via a new pedestrian bridge at the Clock Tower as part of the North Quays Urban Design Framework.

Planning Land Use and Transportation Study (PLUTS)

The development strategy for Waterford City has been guided by the Planning Land Use and Transportation Study (PLUTS) since 2004, which in turn was initiated to provide a strong planning framework for the development of the City and Environs over the period up to 2020. The provision of a new bridge for pedestrians and cyclists to link the proposed redeveloped North Quays with Waterford City Centre, is highlighted as a proposal in the PLUTS strategy.

North Quays Strategic Development Zone Planning Scheme

The Planning Scheme for Waterford North Quays SDZ, published in February 2018, outlines a series of goals, objectives and strategies related to the proposed redevelopment of the North Quays site, and also the proposed pedestrian, cycle and sustainable transport bridge which is the subject of this EIAR. The proposed bridge is mentioned a number of times throughout the planning scheme, and is identified as part of one of the principal goals of the scheme:

> *"To link the north and south side of the city by providing a new sustainable transport bridge crossing and improve accessibility and connectivity by creating an environment that facilitates internal pedestrian and cycle movements".*

The impact that the bridge will have on connecting both the north and south sides of Waterford City; encouraging modal shift from the traditional private car to more sustainable modes such as walking, cycling, electric shuttle bus; and ensuring growth and development of the city is also highlighted. Another of the principal goals listed is *"to* provide *for sustainable patterns of movement and access with priority for pedestrians, cyclists and public transport".*

Considering Waterford City Centre in its existing location on the south side of the River Suir, *"The redevelopment of the North Quays will redefine the existing City Centre and key to this will be the sustainable transport bridge which will provide necessary connectivity but also create a more central focus from which the city centre can concentrically grow".*

5.3 Methodology

The chapter has been prepared in line with the following documents:

- Waterford City Development Plan, 2013 – 2019;
- Waterford Planning, Land Use and Transportation Study (PLUTS), 2004;
- North Quays Urban Design Framework Plan, 2008;
- NRA 'Traffic and Transport Assessment Guidelines', 2014;
- North Quays Strategic Development Zone Planning Scheme 2018

The Department for Transport, Tourism and Sport's "Smarter Travel – a Sustainable Transport Future" was also consulted.

A car parking survey was undertaken on Thursday 9th August 2018 and Saturday 11th August 2018. The results of these surveys are presented in Figures 5.1 to 5.4 in Volume 3 of this EIAR.

Data relating to any collisions in the vicinity of the development site during the 10-year period between 2005 and 2014 was collected from the Road Safety Authority (RSA) online mapping tool and analysed.

The RSA online mapping tool outlines the pattern and location of road collisions in Ireland where personal injury was involved. Details regarding the date, severity level, and circumstances of each collision are provided, along with the type of vehicle involved.

On the southern side of the River Suir, the area along Merchant's Quay, Meagher's Quay, and Clyde Wharf was considered.

An Automatic Number Plate Recognition (ANPR) link count survey was carried out on Tuesday the 25th October 2016. The survey took place for 12 hours between 7am and 7pm and occurred on the roads in the vicinity of the development – including on the road network bounding the North Quays SDZ site, and the R680 along Meagher's Quay.

5.4 Existing Conditions

5.4.1 Road Infrastructure

Currently, the North Quays SDZ site is undeveloped, and is bounded to the north by the Dock Road (R711) – a regional road dual carriageway connecting Waterford City Centre with the N29, located 4.7km to the northeast, as presented in Plate 5.2.

Plate 5.2: Map showing proposed bridge (green), SDZ site (red) and surrounding road network (R711 Dock Rd. & R680 Meagher's Quay)

The R711 Dock Road is a dual carriageway road, with a posted speed limit of 50km/hr near the North Quays SDZ site. There are continuous footpaths on both sides of the R711, with an average width of between 2m and 3m. There are no facilities for cyclists provided, as presented in Plates 5.3 and 5.4.

Plate 5.3, 5.4: Views of R711 Dock Road looking east and west respectively

The landing point of the proposed bridge on the south side of the river is adjacent to the Clock Tower, which borders the R680 at Meagher's Quay. The section of the R680 that runs parallel to the river is a regional single carriageway road, with a speed limit of 50km/hr. The carriageway consists of one lane, width of approximately 3m, in each direction with a planted median (4.5 – 5m wide) between the lanes. There are continuous footpaths on both sides of the R680 of variable width. Cycle lanes are provided on both sides of the carriageway in the immediate vicinity of the Clock Tower; however, at the point approximately 150m to the west of the Clock Tower, the cycle lanes discontinue for the next 200m, meaning that cyclists traversing this section of roadway have to continue on a shared carriageway with vehicular traffic. The existing situation is presented in Plates 5.5 and 5.6.

Plate 5.5: Layout of R680 at Meagher's Quay

Plate 5.6: Planted Median along R680

5.4.2 South Quay Car Parks

There are several public car parks adjacent to the R680, along the quays; namely the Merchants Landing, Clock Tower, and Clyde Wharf car parks as presented in Plate 5.7. They are typically used by a combination of business people, shoppers and visitors to the City. The Clock Tower car park is a busy car parking area in the city centre, consisting of 281 parking spaces, and is open 24 hours a day. There are two entrances, and one exit to/from the car park, all connecting at Meagher's Quay.

Plate 5.7: Plan view of the R680 showing different car parking areas along Waterford City's South Quays

A car parking survey was undertaken at Waterford City Centre on Thursday 9th and Saturday 11th August 2018. These surveys were validated by historical records from Waterford City & County Council and site inspections. The results of the car parking survey show that the existing Clock Tower Car Park was practically fully occupied at peak on the Thursday and was 80% occupied at peak times on the Saturday with approximately 60 spaces available. In total the car parking along the three main car parks on the Quays, including Merchants Quay, Clock Tower and Clyde Wharf there was approximately 130 spaces available on the Thursday at peak times and approximately 160 spaces free on the Saturday at peak times. Looking at the wider publicly available car parking in City Centre, both car parks and on-street parking there is a total of 2,800 spaces within 400m of the Clock Tower, and of this parking was 68% occupied at peak times on the Thursday with approximately 891 spaces available and was 74% occupied at peak times on the Saturday with approximately 729 spaces available. This shows that there is ample available car parking is the City Centre. It is noted that there is variable message signage (VMS) for the City Centre car parks, however, at the time of preparing this report much of the signage was not in use.

5.4.3 Public Transport Facilities

On the south side of the River Suir, Waterford Bus Station is situated just off the R680 Merchants Quay, approximately 150m to the west of the Clock Tower, and is well serviced by both Bus Éireann and private operators. As part of the development of the North Quays SDZ site, it is proposed to relocate Waterford Plunkett Train Station so that it is immediately adjacent to the SDZ site. The station is served by the Waterford – Dublin Heuston and Waterford – Limerick Junction trains.

5.4.4 Pedestrian & Cyclist Facilities

In the current scenario, pedestrian and cyclist connectivity between the North Quays area and Waterford City Centre is poor – the only crossing option is via Rice Bridge, which adds both time and distance to a journey between the Ferrybank area and the city centre, and vice-versa.

The recent development of the Waterford Greenway, a 46km stretch of off-road walking and cycling facilities between Waterford City and Dungarvan, has seen an increase in the number of visitors to Waterford City and the surrounding areas since its official opening in March 2017. According to a report published by Waterford City Council, between March and December 2017 247,545 people used the greenway – 105,639 of this were on foot while 141,906 travelled via bike. At present the greenway concludes at Bilberry, which is approximately 2.1km away from the southern landing point of the proposed sustainable transport bridge at the Clock Tower.

WCCC are progressing The Bilberry to Waterford City Centre Greenway link. This Greenway link involves the provision of a safe pedestrian/cycle route from the existing Greenway car park at Bilberry to the City Centre. The length of the link is approximately 2.1km. The development of this link will connect the existing Greenway to the City Centre and via the proposed Sustainable Transport bridge to the North Quays development and the transport hub contained within, as well as providing a link to the proposed Waterford to New Ross and Waterford to Rosslare Greenways.

The Part 8 for the Waterford to New Ross Greenway has been adopted and the Waterford to Rosslare Part 8 is in progress. The Waterford and New Ross Greenways commence at Abbey Road adjacent to the proposed North Quays SDZ site. This greenway passes through land zoned for the future residential development of the north side of the city and, as such, provides an ideal opportunity to interlink the new housing developments with the city centre on foot or by bicycle.

When complete, the improved connectivity from Bilberry to the City Centre in combination with the delivery of the Sustainable Transport Bridge and North Quays SDZ development will allow pedestrians and cyclists to connect to the proposed Waterford/Kilkenny/New Ross and Rosslare Greenways. The connectivity described above is presented in Plate 5.7.

This will improve vastly pedestrian and cyclist connectivity on the north side of the River Suir. This will further boost the levels of people utilising sustainable means of transport, such as walking and cycling, within the city.

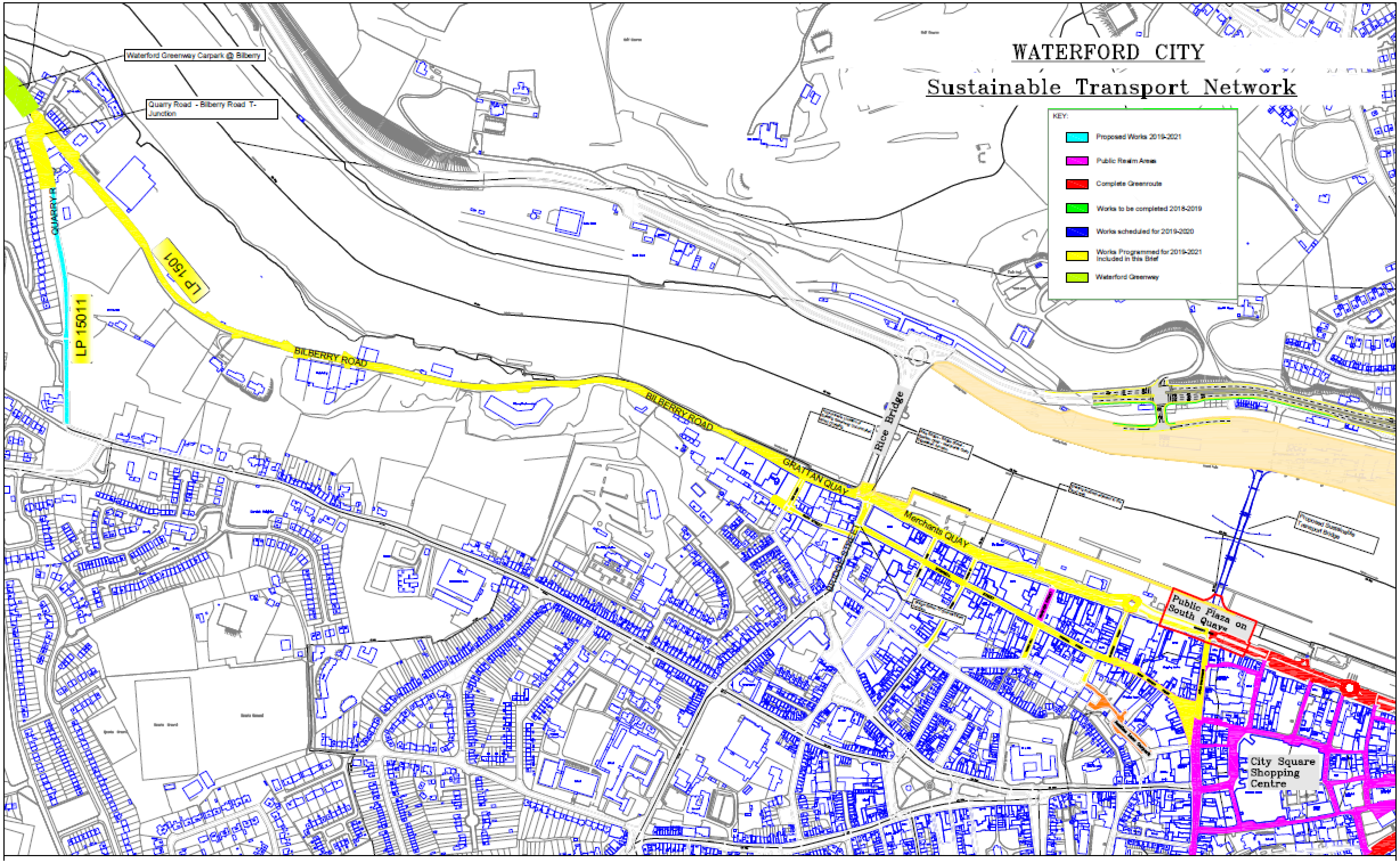


Plate 5.8: Waterford City Sustainable Transport Network Drawing WFD/SE/01

5.4.5 Road Safety

Between 2005 and 2014 a total of 22 accidents were recorded on the south quays, with 19 of them classified as minor, 2 classified as serious, and a further one accident which was fatal.

As the northern landing point of the proposed bridge will be located within the North Quays SDZ development, collision data from the road network to the north of the River Suir along Dock Road was not considered.

The locations of the collisions on the road network near to the development site are indicated in Plate **5.9** and a summary of the collisions in the area is provided in **Table 5.1**.

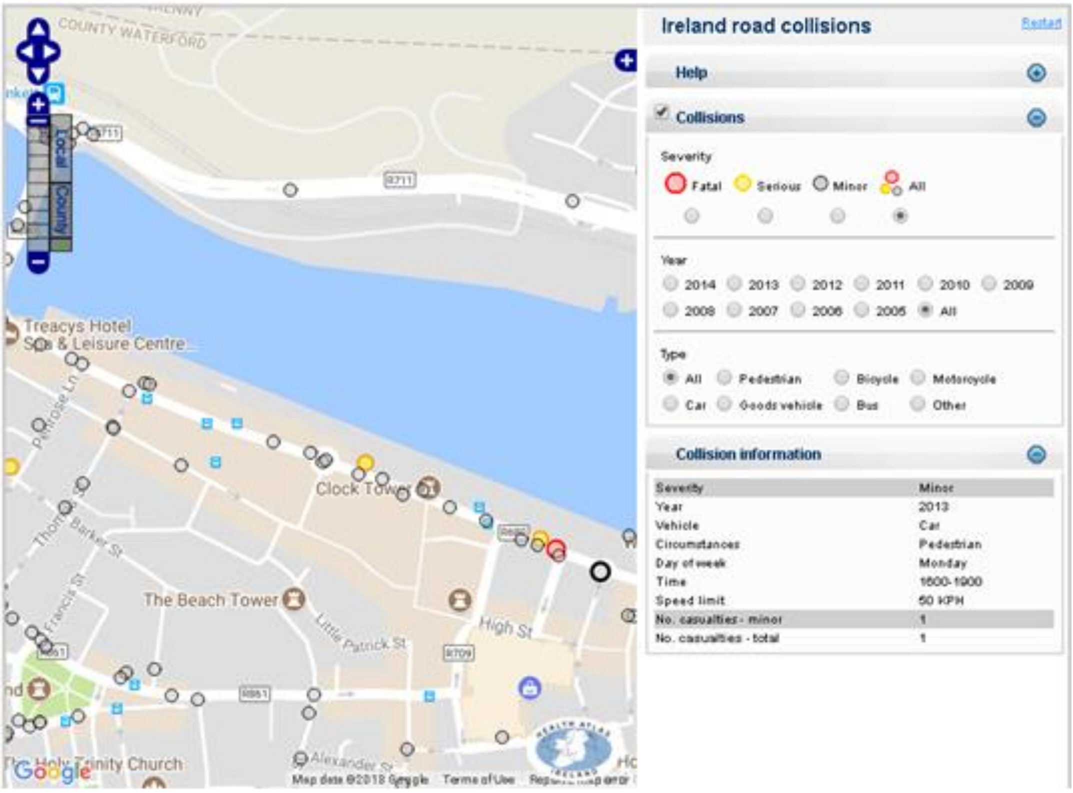


Plate 5.9: Road Collision Data from RSA

Nine of the accidents to date in the area have involved a pedestrian including the fatal and both serious accidents; four involved a bicycle or motor cycle. One third of all minor collisions have had pedestrian involvement, and a further one involved a bicycle.

Table 5.1 Summary of Road Collision Data along R680

Classification	Location	Year	Vehicle Involved	Pedestrian Involved?	Day & Time	No. Casualties
Minor	Merchant's Quay	2007	Motorcycle	No	Sunday, 07:00 – 10:00	1
Minor	Merchant's Quay	2012	Goods Vehicle	Yes	Wednesday, 19:00 – 23:00	1
Minor	Merchant's Quay	2010	Undefined	No	Friday, 10:00 – 16:00	1

Classification	Location	Year	Vehicle Involved	Pedestrian Involved?	Day & Time	No. Casualties
Minor	Merchant's Quay	2011	Goods Vehicle	No	Wednesday, 19:00 – 23:00	2
Minor	Merchant's Quay	2010	Car	No	Sunday, 10:00 – 16:00	1
Minor	Merchant's Quay	2010	Car	No	Sunday, 10:00 – 16:00	1
Minor	Merchant's Quay	2010	Car	No	Monday, 10:00 – 16:00	1
Minor	Merchant's Quay	2014	Car	Yes	Friday, 10:00 – 16:00	1
Minor	Merchant's/ Meagher's Quay	2008	Motorcycle	No	Friday, 19:00 – 23:00	1
Minor	Merchant's/ Meagher's Quay	2012	Goods Vehicle	Yes	Tuesday, 10:00 – 16:00	1
Minor	Meagher's Quay	2006	Car	No	Thursday, 19:00 – 23:00	1
Serious	Meagher's Quay	2008	Undefined	Yes	Thursday, 16:00 – 19:00	1
Minor	Meagher's Quay	2012	Car	No	Monday, 10:00 – 16:00	1
Minor	Meagher's Quay	2006	Bicycle	No	Wednesday, 19:00 – 23:00	1
Minor	Clock Tower	2005	Car	Yes	Sunday, 16:00 – 19:00	1
Minor	Meagher's Quay	2014	Car	No	Friday, 10:00 – 16:00	1
Minor	Meagher's Quay	2005	Undefined	No	Saturday, 10:00 – 16:00	1
Minor	Meagher's Quay	2011	Goods Vehicle	Yes	Tuesday, 16:00 – 19:00	1
Minor	Clyde Wharf	2013	Car	No	Wednesday, 10:00 – 16:00	1
Serious	Clyde Wharf	2006	Undefined	Yes	Thursday, 16:00 – 19:00	1
Fatal	Clyde Wharf	2011	Car	Yes	Tuesday, 16:00 – 19:00	1
Minor	Clyde Wharf	2013	Car	Yes	Tuesday, 07:00 – 10:00	1

5.4.6 Existing Traffic

The peak hours for traffic near to the development are as follows:

- Weekday AM Peak: 08:00 – 09:00
- Weekday PM Peak: 17:00 – 18:00

The flows in the AM and PM peak along the R680 are detailed in Table 5.2.

Table 5.2 AM and PM Peak Flows on the R680 (South Quays)

AM Peak		
Flow in Western Direction	**Flow in Eastern Direction**	**Two-Way Flow**
539 vehicles	793 vehicles	1,332 vehicles
PM Peak		
Flow in Western Direction	**Flow in Eastern Direction**	**Two-Way Flow**
877 vehicles	593 vehicles	1,470 vehicles

The Annual Average Daily Traffic (AADT) level on the R680 in the vicinity of the proposed development is estimated to be around 18,200 vehicles.

As the R680 along the South Quays is one of the primary circulatory routes through the City of Waterford, significant congestion levels are often observed along the stretch of road, particularly during the AM and PM peak hours.

5.4.7 Transport Demand Forecast

At present Rice Bridge forms a pinch point on the connection from the northern suburban area to the city centre and challenges the provision of an efficient local public transport service that connects all areas of the city.

At present pedestrian and cyclist connectivity between the North Quays area and Waterford City Centre is poor. Data taken from the 2016 Central Statistics Office (CSO) census shows the following modal split for the combined electoral divisions of Ferrybank and Kilculliheen (situated on the north side of the River Suir). These areas are dependent on the private car, as over 70% of people commute to work, school or college using this mode (either as a driver or passenger). Only 13% of commuters travel on foot, and a mere 1% travel by bicycle on their commute, as presented in Plate 5.10.

The walk and cycle catchment areas either side of the River Suir at the proposed bridge are presented in Plates 5.11 and 5.14.

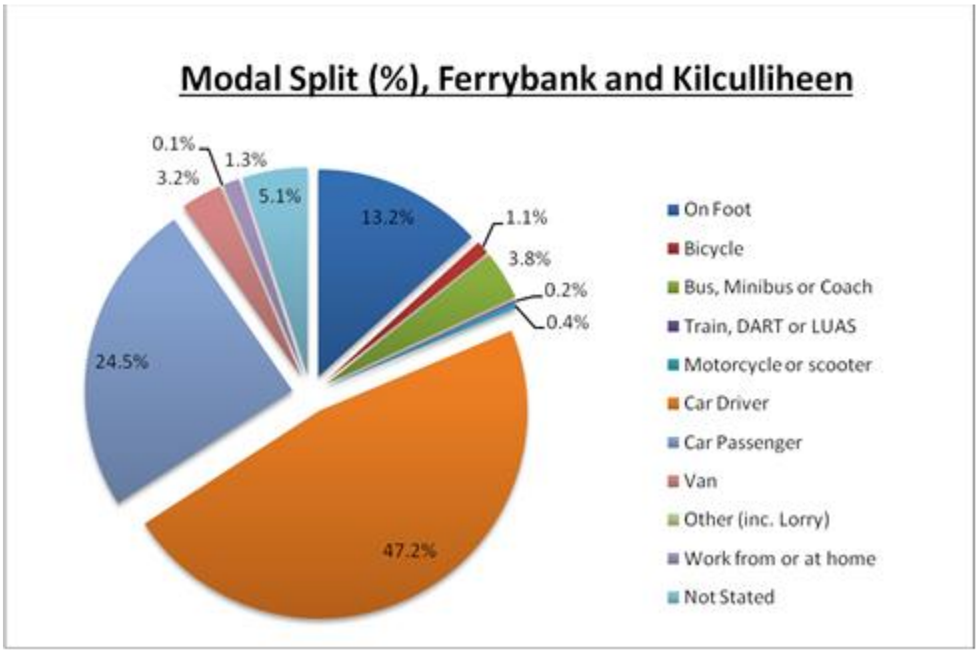


Plate 5.10: **Commuter Modal Splits, Ferrybank and Kilculliheen electoral divisions**

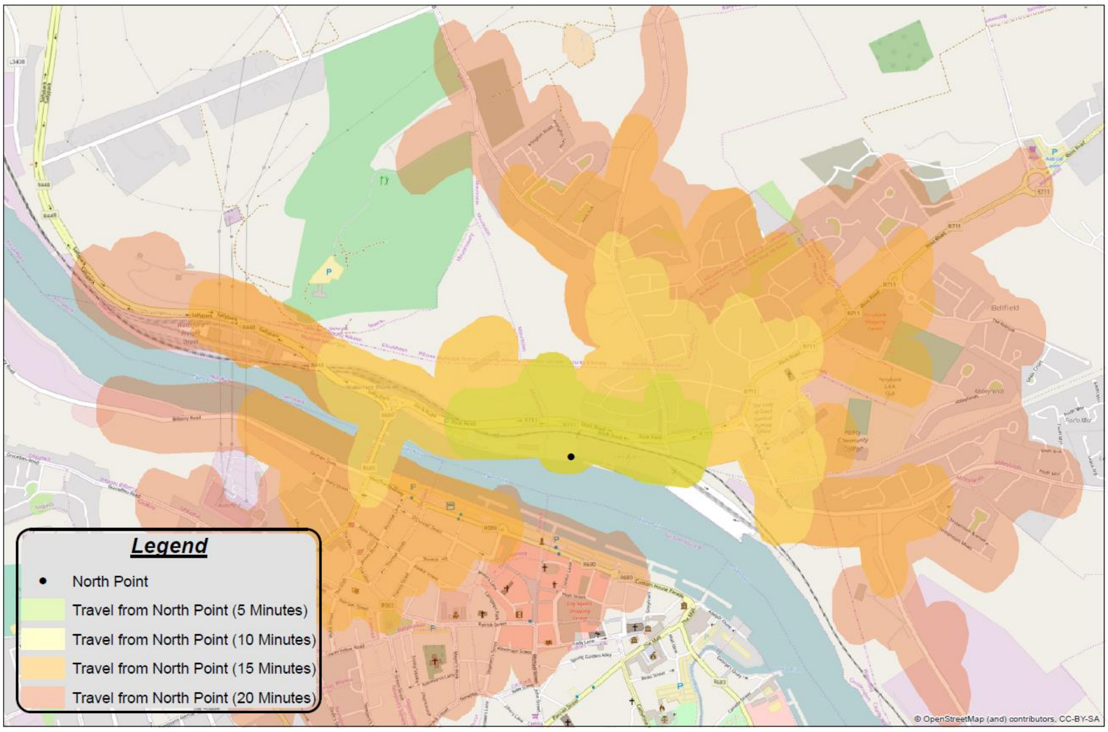


Plate 5.11: **Walking Isochrone Map from proposed northern landing point of bridge, in present scenario**

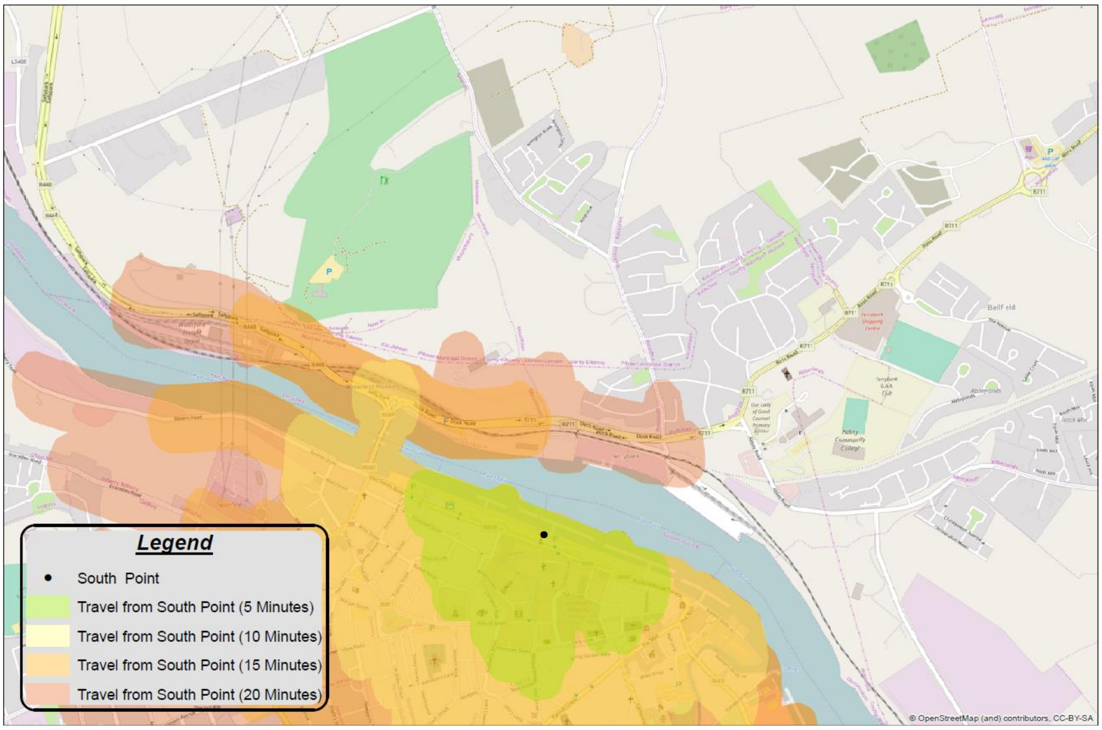


Plate 5.12: Walking Isochrone Map from proposed southern landing point of bridge

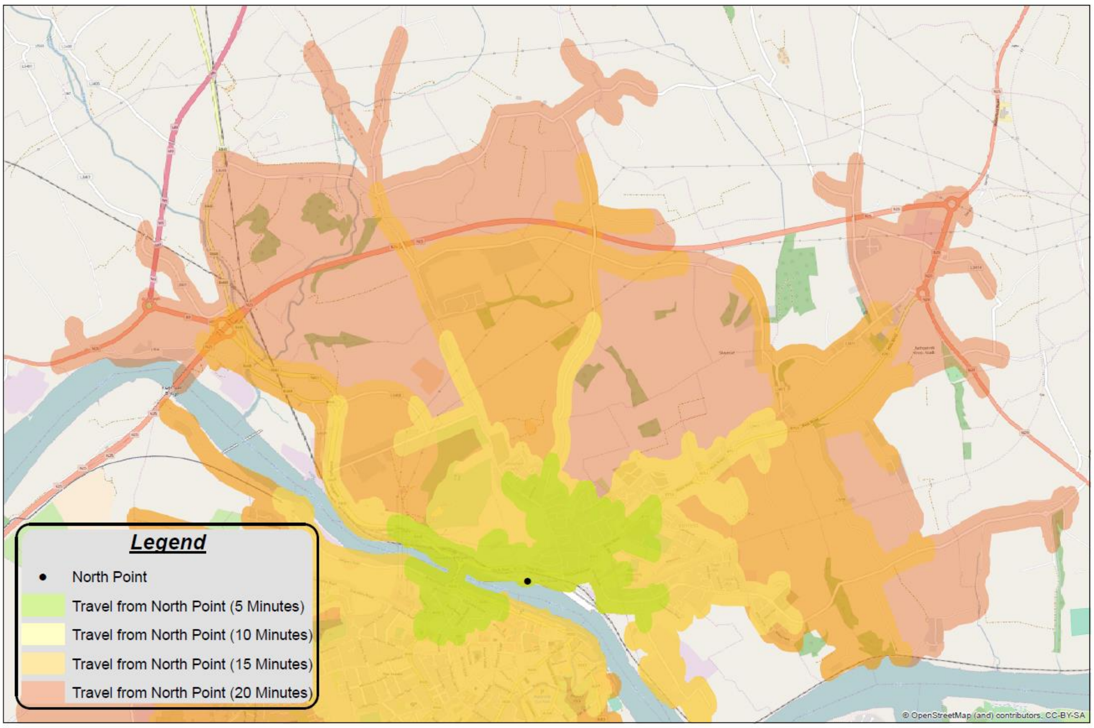


Plate 5.13: Cycling Isochrone Map from proposed northern landing point of bridge, in present scenario

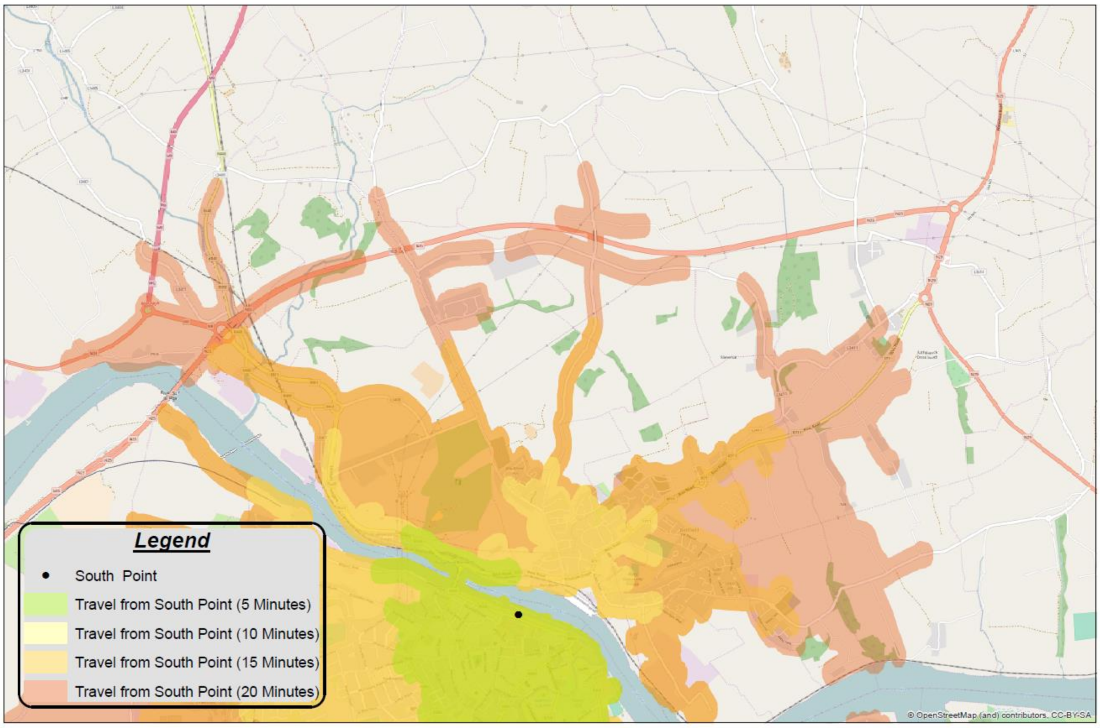


Plate 5.14: Cycling Isochrone Map from proposed southern landing point of bridge

5.5 Proposed Development

The proposed pedestrian, cycle and electric shuttle bus bridge will link the North Quays of Waterford to Meagher's Quay (near the Clock Tower) in the City of Waterford. The bridge will be 207m long and will provide a continuous link connecting the City Centre retail spine to and through the North Quays SDZ and the surrounding areas, such as Ferrybank, Abbeylands and Rockshire.

This bridge will provide significantly improved access to the exiting city centre for pedestrians and cyclists; and a vital link in the connection of the Waterford Greenway to the proposed New Ross - Waterford Greenway & proposed Rosslare Greenway, as presented in Plate 5.16.

The bridge will be 8m wide, apart from two points along its length, at which the width widens to 11.2m to accommodate viewpoint/rest areas on the bridge. Cyclists and an electric shuttle bus will be facilitated through a shared-space lane, 4.5m in width, whilst pedestrians will have a 3.5m wide lane for their use. Differing surfaces will be used to distinguish the pedestrian-only corridor from the remaining shared-space area on the bridge. The bridge layout is presented in Figures 4.2 and 4.5 of Volume 3 of this EIAR.

Approaching from the North Quays, the pedestrian-only corridor runs along the easternmost side of the bridge, and approximately halfway across the bridge span the alignment switches so that the pedestrian corridor follows the westernmost side of the bridge until its tie in with the south quays. This will allow pedestrians to safely and conveniently access the viewing/rest points proposed for the east and west side of the bridge.

Priority will be given to the pedestrian corridor at the crossing point from the eastern side to the western side of the bridge at its midspan.

The northern landing point of the bridge will be situated in the heart of the North Quays SDZ site, whilst the southern landing point will be located adjacent to the Clock Tower and directly in line with Barronstrand Street/Michael street which is the main pedestrianised spine of the existing city centre. The tower itself will become a landmark point within the Southern Quay 'plaza' area, which will take the form of a 'shared space' area for pedestrians, cyclists and a shuttle bus approaching and departing from the bridge. This shared space will include the space to accommodate the shuttle bus making U-turn movements and can connect to and from the south quays.

This plaza will link in to the R680 Meagher's Quay, and enhanced toucan crossing points will be provided, in place of the existing pelican crossing, to allow easy access for pedestrians and cyclists to and from the pedestrianised Barronstrand Street that links the south quays with the City Centre, as presented in Plate 5.15.

Plate 5.15: Proposed Southern Quay Plaza area

Proposed bridge layout drawings are shown on Figures 4.2 and 4.5 of Volume 3 of this EIAR, while the proposed construction sequence is indicated on Figures 4.8-4.11 in Volume 3 of this EIAR.

Plate 5.16: Roads Layout and Access Points (Extracted from the Waterford North Quays SDZ Planning Scheme 2018)

5.6 Transport Demand Forecasts

It is anticipated that the proposed bridge will encourage modal shift from cars towards more sustainable means of transport (i.e. walking, cycling, and electric shuttle bus), for people travelling from the suburbs north of the River Suir towards Waterford City Centre. This should also reduce the amount of traffic using Rice Bridge and therefore improve the bottleneck situation that currently exists. Plate 5.16 depicts the potential pedestrian circulation across the bridge, through the SDZ site and beyond.

The construction of the proposed new sustainable transport bridge increases the potential walking catchment from the City Centre to the areas north of the River Suir by approximately 4,000 people, and the cycling catchment by approximately 7,400 people. Should there be a mode shift for these areas, equivalent to the areas in Waterford City south of the River Suir, this would equate to nearly 1,000 fewer car trips at peak times.

5.7 Predicted Impacts

5.7.1 Assessment of Existing Traffic Conditions on South Quays

Traffic moves along the South Quays relatively well. In the vicinity of the proposed South Quays Plaza are roundabouts, one at the junction with Gladstone Street and the other at the junction of Keyser Street, both of which are operating well within capacity. There is also a pedestrian pelican crossing of the Quays either side of the Clock Tower, where traffic is not significantly delayed.

5.7.2 Construction Phase

The construction phase of the project is anticipated to last for approximately 18-24 months. The impacts that the construction phase will have on the surrounding environment, particularly the roads and traffic network, have been considered.

Plate 5.16: Aerial View of Waterford's southern quay showing Clock Tower Car Park (orange) and proposed bridge location (green)

A large part of the Clock Tower Car Park area will be closed for the duration of the works to facilitate the construction of the proposed bridge, southern plaza area, and connection to the adjoining road network.

The Clock Tower Car Park is a busy car parking area in the city centre, consisting of 281 parking spaces and open 24 hours a day. There are two entrances, and one exit to/from the car park, all from R680 at Meagher's Quay.

Therefore, the closure of 200 of the car park spaces during the construction phase will have a moderate impact on the traffic movements on the surrounding road network, particularly the R680.

Furthermore, any traffic travelling to/from the site will use the R680. Traffic will include vehicles transporting bridge elements, construction vehicles including cranes, and other general construction traffic.

The contractor will be required to prepare a Construction Environmental Management Plan (CEMP) and associated Traffic Management Plan (TMP) that maximises the safety of the workforce and the public and minimises traffic delays, disruption and maintain access to properties. The Traffic Management Plan will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points. The contractor shall provide an appropriate information campaign for the duration of the construction works.

5.7.3 Operation Phase

The proposed development will result in the permanent removal of 150 spaces from the Clock Tower car park. While there is some spare capacity in the existing car park, the removal of these spaces will result in the redistribution of parking demands to other nearby car parks. Surveys undertaken at these car parks have shown that they spare capacity to accommodate this redistribution of car parking demands.

The Department for Transport, Tourism and Sport's document, entitled "Smarter Travel – a Sustainable Transport Future", indicates that by 2020, the aim is that 55% of all commuter-based trips will be undertaken by sustainable transport modes, including cycling and walking; with the remaining 45% of trips being undertaken by private car. The provision of the proposed sustainable transport bridge would therefore greatly benefit these commuters and would likely encourage people to swap to active transport modes for their commute.

It is anticipated that with the provision of the proposed bridge, the overall travel distances for pedestrians and cyclists between the City Centre and these residential areas will be reduced by up to 1km or equivalent to 12-14 minutes' walk or 5 minutes cycle - the improvement in walk and cycle accessibility is demonstrated in the isochrone maps in Plates 5.11-5.14. This has the potential to reduce the number of car trips at peak times by up to 1,000 vehicles.

5.8 Mitigation Measures and Residual Impacts

No mitigation measures are deemed necessary as no significant impacts are predicted as standard best practice measures are incorporated into the project design.

5.9 References

Waterford City Development Plan, 2013 – 2019

Waterford Planning, Land Use and Transportation Strategy (PLUTS)

North Quays Urban Design Framework Plan, 2008

NRA 'Traffic and Transport Assessment Guidelines', 2014

North Quays Strategic Development Zone Planning Scheme 2018

Waterford North Quays Strategic Development Zone, Traffic & Transportation Impact Assessment, October 2017.

www.cso.ie 2016 Census data.

Chapter 6
Population and Human Health

Chapter 6 Population and Human Health

6.1 Introduction

This chapter addresses the potential population and human health impacts relating to the construction and operational phases of the River Suir Sustainable Transport Bridge referred to hereafter as "the proposed development". The proposed development will form a significant part of the transport infrastructure of Waterford City, specifically relating to the future development of the North Quays Strategic Development Zone (NQ SDZ). Actual and perceived impacts of the proposed development on the population and human health may arise from various aspects of the proposed development. These impacts are dealt with throughout this Environmental Impact Assessment Report (EIAR). In particular, interactions may occur with effects described in a number of chapters and require specialists input as provided in Table 6.1.

Table 6.1 Population and Human Health Interactions and Specialist Contributions

Relevant Aspects	Chapter & Specialists Contributor
Human Health: Traffic	Chapter 5: Traffic: Roughan & O'Donovan
Human Health: Contaminated Land	Chapter 8: Land and Soils: Roughan & O'Donovan
Human Health: Noise and Vibration	Chapter 12: Noise and Vibration: AWN
Human Health: Air Quality and Climate	Chapter 13: Air Quality and Climate: AWN
Human Health: Water Quality and Flooding	Chapter 10: Hydrology: Roughan & O'Donovan
Human Health: Material Assets	Chapter 16: Roughan & O'Donovan
Human Health: Major Accidents and Emergencies	Chapter 17: Major Accidents, Interactions and Cumulative Effects Outline Environmental Operating Plan (Appendix 4.1): Roughan & O'Donovan

In accordance with the draft EPA Guidelines (2017), the relevant components of this chapter will examine the attributes and characteristics associated with:

- Land use and social considerations, including effects on general amenity, journey characteristics, severance, amenity uses of the site or of other areas in the vicinity;
- Economic activity including tourism e.g. employment and population including associated land use; and
- Human health, considered with reference to and interactions with other environmental receptors contained in corresponding chapters such as air, noise, traffic, flooding, as appropriate.

This chapter sets out the methodology used for the population assessment and human health assessment (Section 6.2), then describes the receiving environment (Section 6.3) and sets out the predicted impacts of the proposed development on population and human health aspects (Section 6.4). The mitigation measures are set out that are (Section 6.5) recommended to be incorporated into the design of the proposed development and details of any residual impacts are set out in Table 6.16 and described in Section 6.6. This chapter also outlines any difficulties encountered in compiling information (Section 6.2). A conclusion and a summary of the assessment are provided in Section 6.7 with a summary of the significant predicted impacts and mitigation also provided in Table 6.16. A list of reference material used to compile this chapter is contained in Section 6.8.

6.2 Methodology

This population and human health impact assessment has been undertaken in accordance with Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as amended in turn by Directive 2014/52/EU and transposed into Irish Law through Regulations S.I. No. 296 of 2018. The methodology devised is based on established best practice with cognisance given to all relevant guidelines and legislation.

6.2.1 Relevant Guidelines

The following guidelines have influenced the preparation of this chapter:

- Draft Guidelines on information to be contained in the Environmental Impact Assessment Report, (Environmental Protection Agency, August 2017);
- Draft Advice Notes for preparing environmental impact statements (Environmental Protection Agency September, 2015);
- Guidelines on the information to be contained in Environmental Impact Statements (Environmental Protection Agency, 2002);
- Advice notes on current practice (in the preparation of Environmental Impact Statements) (Environmental Protection Agency, 2003);
- Environmental Impact Assessment of national road schemes - A practical guide (National Roads Authority/ Transport Infrastructure Ireland, Revision 1, November 2008);
- Guidelines on the treatment of Tourism in an Environmental Impact Assessment, Fáilte Ireland (2011);
- Additionality Guide (Homes and Communities Agency (UK)) 2014);
- Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report (European Commission 2017);
- Health Impact Assessment Resource and Tool Compilation (US EPA 2016);
- Health Impact Assessment (Institute of Public Health Ireland 2009)
- *Framework for Human Health Risk Assessment to Inform Decision Making* (2014) developed by the United States Environmental Protection Agency (US EPA), the latest draft EPA Guidelines (2017)

The description of the quality, significance, extent (magnitude), probability and duration of effects outlined within this assessment are based on the definitions set out within Section 3.7 of the 'Guidelines on information to be contained in Environmental Impact Assessment Reports' (EPA, Draft 2017).

6.2.2 Study Area

There is no national guidance available on an appropriate study area to focus the assessment of population and human health. The study area has been defined with reference to the potential for impact from the proposed development using professional judgement and based on availability of relevant information.

The primary study area is defined by the Electoral Divisions (EDs) that are wholly and/or partially contained within 500m of the proposed development, as presented in Plate 6.1. These can be defined by north and south of the River Suir, namely:

- North of the River Suir: Ferrybank ED (in Waterford City) and Kilculiheen ED (located mainly in County Kilkenny).
- South of the River Suir: Centre A, The Glen and Custom House B, Custom House A and Centre B, and parts of Ballybricken, Shortcourse and Mount Sion EDs

The human health study area is related to the potential impacts of any emissions as a result of the proposed development. Generally, the closer to the works, the greater the potential for impacts. The most significant environmental impacts are likely to be confined within 50-100m of the proposed development. Some impacts such as noise, air quality and traffic may have a wider study area, and these are defined and considered as part of the respective specialist chapters as part of this EIAR that inform this assessment.

It is recognised that transport infrastructure can influence activities across a wide area. For this reason, a wider 'context' study area of 1km is also included in order to fully inform this assessment. Where population or human health information is not specifically available for the defined EDs within the 500m, information relating to the Waterford City and/ or environs is relied upon. The study area also includes the marine environment - the River Suir, in terms of potential for economic impact on boating, and tourism from the proposed development. The extents of the 500m study area and the 1km 'context' study area are shown in Plate 6.1.

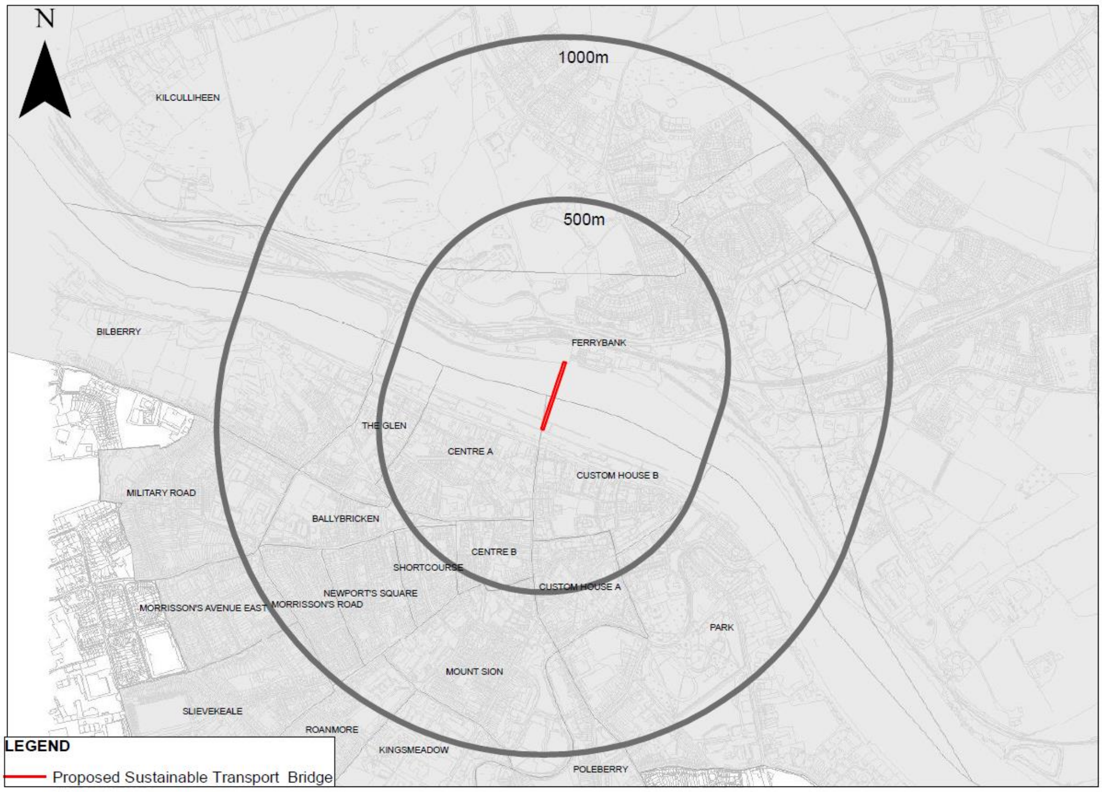


Plate 6.1 Study Area for Population and Human Health Assessment

6.2.3 Data Collection Methods

The data collection methods include a mixture of primary and secondary data collection and analysis. Initially a desk-based assessment determined the existing receiving environment (in terms of population and human health), including the existing population, future population projections, existing and future economic activity in the area, employment, community infrastructure, tourism and recreation amenities. Google maps and site visits were also used to inform and validate the baseline description.

Site visits covering the study area were undertaken in June 2018. The purpose of the site visits was to review and record the land use and property types located within the immediate 50-100m study area to inform the baseline assessment and to determine the location of potentially sensitive receptors i.e. residential properties, businesses, community infrastructure (schools, hospitals), tourism and recreational amenities.

6.2.4 Data Sources

The population and human health assessment require that an understanding of the community and characteristics of the area is built up through background research, site visits, and discussions with local people and community representatives.

Data sources consulted include:

- Population, demographic and health data from Census 2016 and 2011 by the Central Statistics Office (CSO); Pobal and Institute of Public Health (IPH) and Health Service Executive (HSE);
- Other relevant environmental data considered during the various environmental assessments, particularly traffic, noise, air and climate, water, land and soil and landscape and visual impacts;
- Site visits to undertake observations of local settlement and travel patterns, identify the location of community facilities.
- Consideration of issues/ concerns raised during public consultations

A range of policy documents that may affect existing and future populations were also reviewed including:

- Project Ireland 2040 – National Planning Framework 2040 and National Development Plan 2018-2027;
- Regional Planning Guidelines for the South East Region 2010-2022;
- Regional Spatial and Economic Strategy (Draft Issues Paper);
- National Spatial Strategy 2002-2020;
- South East Region Employment Action Plan 2011;
- South East Economic Development Strategy (SEEDS) 2013-2023;
- Kilkenny City and Environs Development Plan 2014-2020;
- Kilkenny County Development Plan 2014- 2020;
- Waterford City Development Plan 2013- 2019 (incorporates the Housing Strategy);
- Waterford County Development Plan 2011-2017;
- North Quays Strategic Development Zone Planning Scheme (adopted February 2018);
- Ferrybank- Bellview Local Area Plan 2017 – 2023;

- One Waterford: Local Economic & Community Plan 2015-2020;
- Report of the Waterford Re-Organisation Implementation Group and Economic Strategy for Waterford City and County, One Waterford – Delivering Jobs, Efficiency and Growth (2013);
- Waterford Children & Young People's Services Committee Children & Young People's Plan 2015-2018;
- Waterford City & County Council Corporate Plan 2014-2019;
- Waterford City Retail Strategy (2012);
- Strategic Plan 2014 – 2017 Waterford – Active People, Active Place;
- Waterford City Centre Urban Renewal Scheme (2015);
- Waterford Planning, Land Use and Transportation (PLUTS) Study (2004);
- Transforming Waterford Integrated Transport Proposals;
- Literature review – bridges, sustainable transport bridges; and
- EIA Scoping Report for the Waterford City Sustainable Transport Bridge and relevant consultations received.

6.2.5 Consultation

Feedback relating to population and human health is summarised in this section. This includes feedback, concerns, issues raised by consultees, stakeholders and the public during site visits, written submissions received and as a result of a public consultation event held on the 18th July 2018. The issues/ concerns are split into construction and operation phase to include:

Construction Phase:

- Concerns regarding construction phase and the associated impacts on properties and business due to construction activities including disruption to traffic, noise, air.
- Impacts on Waterford City Marina and boat operators using the River.
- Impacts to economic operators upstream on the River Suir.

Operational Phase:

- Concerns that the bridge will create an obstruction during search and rescue events.
- Concerns over the concept of shared space between pedestrian and cyclists and the electric bus.
- Accessibility of the shuttle bus i.e. wheelchairs, buggies.
- Concerns regarding wind shielding, rain, icing and suicide prevention measures of the bridge.
- Concern regarding traffic congestion, cars, pedestrians and cyclists when Rice Bridge and River Suir Bridge are being opened to allow river navigation.
- Comments in relation to requirement for 24/7 lighting system and CCTV and deterring anti-social behaviour i.e. homelessness/ begging on bridge.
- Concern from business group that bus route should connect Apple Market/ Michael Street area to NQ SDZ.
- Concerns regarding future Tall Ships events.

Meetings were arranged with Inland Fisheries Ireland, Boating/ Cruises, Port of Waterford and Marina operators, NPWS, schools and tourism operators during the design stage. In some cases, the consultation process has resulted in design changes and/ or agreement of appropriate mitigation measures. Where relevant, this mitigation has been integrated into this assessment.

6.2.6 Difficulties Encountered

No particular difficulties were encountered in preparing the population assessment. In terms of the human health assessment, there are uncertainties in relation to assessing impacts on individuals or communities due to the lack of available health data and the difficulty in predicting effects, which could be based on a variety of assumptions.

6.2.7 Population Impact Assessment Categories

6.2.7.1 Overview

The purpose of the population assessment is to identify the likely significant impacts as they might affect users of the proposed development and the local community. It usually follows that impacts of a population and human health nature are a function of:

- The location and character of the local environment;
- The sensitivity of the local population and its capacity to absorb change;
- The nature of the environmental effect;
- The scale or extent of the effect in terms of area or population affected;
- The duration and frequency of an effect; and,
- The probability of an impact's occurrence and possibility of effectively reducing the effects (mitigation).

Impacts result from direct, indirect, secondary and cumulative effects on existing environmental conditions. Effects can be *positive, neutral* or *negative*. Significance of an effect depends on, among other considerations, the nature of the environmental effect, the timing and duration of an effect and the probability of the occurrence of an effect. The significance of an effect is described as *imperceptible, slight, moderate, Significant*, *Very Significant* or *Profound*. The impacts may be short-term, medium-term or long-term. The duration of an effect may be *momentary, brief, temporary, short-term, medium-term, long-term, permanent or reversible* in accordance with the timescales detailed in Table 6.2. The frequency of that effect can also influence significance i.e. if the effect will occur once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually. For example, disruption to road for a few hours could be described as having an *imperceptible, negative, brief* impact versus the complete closure of a road for a number of months which could be described as a *very significant, negative*, *temporary* impact.

The population and human health assessment addresses impacts at a community level rather than for individuals or identifiable properties, although impacts for individual properties are discussed where these are significant or located within close proximity to the proposed development, as appropriate.

The EIAR is focused on providing a clear documentary trail of analysis used to arrive at conclusions. The criteria used to describe the predicted effects across landuse and social considerations including journey characteristics, journey amenity, general amenity and economic impacts is outlined in Table 6.2 (adapted from the EPA Guidelines, 2017).

Table 6.2 Criteria used to describe population effects (adapted from the EPA, 2017)

Quality of Effects:	
Positive	A change which improves the quality of the environment.
Neutral	No effects, or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative	A change which reduces the quality of the environment.
Describing Significance of effect:	
Imperceptible	An effect capable of measurement but without significant consequences on population.
Not significant	An effect which causes noticeable (*Note 1*) changes in the character of the population environment without affecting its sensitivities.
Slight effects	A small effect which causes noticeable changes in the population and character of the environment without affecting its sensitivities.
Moderate effects	An effect that alters the character of the population environment in a manner that is consistent with existing and emerging baseline trends.
Significant effects	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the population environment.
Very significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the population environment.
Profound effects	An effect which obliterates sensitive characteristics.
Describing the Extent and Context of Effects:	
Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Probability of the Effects:	
Likely effects	The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
Unlikely effects	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measure are properly implemented.
Describing the Duration and Frequency of Effects:	
Momentary effects	Effects lasting from seconds to minutes
Brief effects	Effects last less than a day
Temporary effects	Effects lasting less than a year
Short-term effects	Effects lasting one to seven years
Medium-term effects	Effects lasting seven to fifteen years
Long-term effects	Effects lasting fifteen to sixty years.
Permanent effects	Effects lasting over sixty years
Reversible effects	Effects that can be undone, for example through remediation or restoration.

Frequency of effects	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hour, daily, weekly, monthly, annually).
Note 1:	*for the purposes of planning consent procedures*

The relevant components of the population aspects of this Chapter will examine the attributes and characteristics associated with social considerations of the community to include; land use change, journey characteristics and general amenity, severance, and economic activity including tourism e.g. employment and population including associated land use as a result of the proposed development.

6.2.7.2 Land Use Change

Land use changes can affect populations in different ways. Planning policy plays an important role in guiding and facilitating approximate changes in land use which can influence settlement as well as transportation patterns. Planning policy ensures these changes are managed sensitively and are appropriate to the unique, existing and emerging social, economic and environmental conditions. The primary consideration relating to land use change is to assess whether the proposed development conforms with land use policy and to identify if the proposed development is likely to change the intensity of patterns, types of activities and land uses. Therefore, a review of planning policy was carried out as part of this assessment as well as an assessment of the existing and emerging baseline and its capacity to absorb predicted changes.

6.2.7.3 Journey Characteristics

Journey length refers to the distance associated with a journey, whilst duration is the time taken to make the journey. Average walking speed for pedestrians is taken to be 5 km/h. Average cycling speed is assumed at 20 km/h. Impacts on journey amenity and community severance are described below. There are obvious interactions between each of these categories and with economic impacts and therefore the assessment is combined with positive impacts resulting from a decrease in journey length/ time and negative impacts resulting from an increase in journey length/time. In addition, new transport facilities can improve accessibility or connectivity through the combined effect of reduced journey time and reduced severance.

6.2.7.4 Journey Amenity and General Amenity

The assessment of journey amenity relies on the significance categories given in Table 6.2 and is supported by cross-reference where necessary with the relevant Chapters. The level of traffic on a road, the proximity and separation of footpaths and cycle-paths, the nature of any crossings/junctions to be negotiated, the legibility of a journey (including signage), visual intrusion (including sightlines) and safety for equestrians, are amongst the factors relevant to the assessment of amenity, as are the number and types of people affected. The principal concern is with pedestrians and cyclists, but journey amenity impacts also apply to drivers; for example, due to safety and anxiety associated with the crossings of major roads. There are interactions, too, with the assessment of journey characteristics and community severance.

6.2.7.5 Severance

The definition of severance is not precise. Severance is an impact of transport infrastructure development such as roads or bridges. Its effect is to discourage community interaction and it occurs where access to community facilities or between neighbourhoods is impeded by a lengthening of journey time or by the physical barrier. For example, construction of a road can result in a physical barrier but can also create further severance affecting communities due to high traffic volumes or perimeter fencing.

The type of severance depends on the location of community facilities, the level of use of facilities, the time of day or duration when traffic conditions are experienced, the sensitivity of the population affected and the geographical spread of the community. Children, the elderly, the mobility impaired and people without access to a private car would be amongst those most affected by community or social severance and any corresponding loss of neighbourhood interaction or safety concerns caused by barriers such as roads/ bridges. On the other hand, relief from existing severance may be provided by a new road/bridge where traffic volumes or speed are moderated, by the inclusion of crossing facilities in the design or through the presence of overbridges or underpasses. New severance is a negative impact that occurs when a barrier is created between people and community facilities.

Sensitive groups are identified specifically where they comprise a higher proportion of pedestrian journeys or where specific amenities are associated with these groups. Sensitive groups can include young and older population cohorts, the mobility impaired and people at risk of social isolation. Relevant facilities include schools, surgeries, hospitals, churches, post offices and shops.

Table 6.3 Criteria Used in the Assessment of Severance

Impact Level	Significance Criteria
Imperceptible	No noticeable consequences for journey patterns
Not significant	Some minor effects on connectivity but present journey patterns are maintained.
Slight	Slight effects on connectivity but journey patterns are maintained with some hinderance to movement.
Moderate	Moderate effects on connectivity. Some moderate hinderance to movement is likely to be experienced by some populations but journey patterns maintained.
Significant	Significant effects on connectivity i.e. changes could dissuade/ promote populations from making particular journeys or result in requirement for alternative route to origin and destination.
Very Significant	Very significant effects on connectivity i.e. dramatic changes could dissuade/ promote populations from making particular journeys or result in requirement for alternative route to/from origin and destination.
Profound	Profound changes to connectivity. Populations are likely to be required to completely alter journey patterns.

Relief from severance is a positive impact which can be defined in relation to existing severance. Relief from severance could follow from a transference of traffic from improvements to road design or sightlines, or from the introduction of crossing facilities, underpasses or bridges. Table 6.3 provides a guide to criteria used in the assessment of relief from severance. Where the assessment varies from these definitions due to the context in which the relief occurs, the reasons for the assessment are discussed in the text. Where there are implications for real and perceived safety, there are also potential interactions with journey amenity.

6.2.7.6 Economic Impacts

Economic and employment impacts occur at both the regional and local scale and can be either positive or negative. Transport infrastructure is normally proposed with the intention of improving national competitiveness and economic/social linkages; for instance, in relation to improving access to areas, reducing journey time and improving journey time reliability for commercial goods, or for travel and commuting of tourists and the workforce. However, there can also be negative impacts in relation to loss of passing trade to businesses, car parks and those who rely on vehicular access which may be affected by transport infrastructure.

Economic impacts are assessed at a community level however development may affect identifiable local business. In this case, impacts on individual companies are discussed where relevant. Other economic impacts could affect the wider community, for example where a number of businesses are affected, tourism, or where the retail or business environment of a City/town is impacted.

6.2.8 Human Health Impact Assessment Categories

This section describes the methodology relating to the assessment of human health effects. Health, as defined by the World Health Organization (WHO), is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." The United States Environmental Protection Agency (USEPA) Human Health Risk Assessment is a useful framework for considering potential human health impacts. It includes four basic steps to inform decision making detailed in the table below.

Table 6.4 Framework for considering potential human health risk/impacts. (informed by USEPA)

Step 1 – Hazard Identification	Examines whether a stressor has the potential to cause harm to humans and/or ecological systems, and if so, under what circumstances. For example, in the case of transport infrastructure project one might consider an emission such as noise or air pollutants and examine its potential for harm.
Step 2 – Dose Response Assessment	Examines the numerical relationship (emission standards) between exposure and likely human health response/effects. For example, typically when the dose/ emission increases the response/health effect increases. Some individuals may have a different dose response/ health effect than others e.g. vulnerable groups such as the old, very young or sick.
Step 3 – Exposure Assessment	Examines what is known about the frequency, timing, and levels of contact with a stressor (e.g. emission). For example, estimating human exposure to an emission/agent in the environment or estimating future exposure of an agent that has not yet been released/ present in the environment.
Step 4 – Risk Characterisation	Examines how well the data support conclusions about the nature and extent of the risk from exposure to environmental stressors. A risk characterisation conveys the risk assessor's judgment as to the nature and presence or absence of risks, along with information about how the risk was assessed, and where assumptions and uncertainties still exist. (This includes cross-referencing with the other environmental chapters of this EIAR).
Note: Informed by USEPA	

6.2.8.1 Significance of Health Effects

The assessment of significance relates to the identification and assessment of potential human health effects on the community. It does not assess effects on an individual basis. It is recognised that some individuals may have a different response to effects than others. Examples might include vulnerable groups, such as the elderly, very young or the sick.

The EPA Revised Draft Guidelines on the information to be contained in Environmental Impact Statement (August 2017) states, *"The evaluation of effects on these pathways* *is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment."*

The significance criteria to assess human health effects is defined in Table 6.2 (as per EPA revised Guidelines). The quality of impact (*positive, negative or neutral*), the probability, duration and timing of effects that are used to qualify the type of human health impact are defined in Table 6.5.

Table 6.5 Criteria Used in the Assessment of Human Health Impacts (adapted from the EPA)

Impact Level	Significance Criteria
Imperceptible	An effect capable of measurement but without significant human health consequences.
Not significant	An effect which causes noticeable changes in the character of the environment without affecting the community human health sensitivities.
Slight	A slight/ small effect which causes noticeable changes in the reported symptoms of the population without affecting the community human health sensitivities (morbidity or mortality).
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging community's human health baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment affecting human health (morbidity or mortality).
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters **most o**f a sensitive aspect of the environment affecting the community's human health (morbidity or mortality).
Profound	An effect which changes a sensitive characteristic of the environment that profoundly affects the human health status of the community.

6.2.8.2 Health Based Standards

Health based standards are set by bodies such as World Health Organisation (WHO) and the European Union (EU). The standards are environmental health thresholds set for a range of environmental parameters to ensure no adverse health effects on the most vulnerable in society. For example, air quality and noise levels are set at levels to protect the vulnerable, not the robust (see Chapter 12 Noise and Vibration and Chapter 13 Air Quality and Climate for the relevant standards). These standards are set to ensure scientific analysis (i.e. modelling) is undertaken on the baseline environment which includes an analysis of the likely changes in the receiving/baseline environment as a result of the proposed development to predict potential human health effects. This results in a level of certainty in relation to the potential effects (positive or negative) before a project is developed. This scientific analysis provides decision makers with a clear methodology outlining what information was used, data gaps and any assumptions that were made in order to provide a comprehensive assessment of impacts on human health.

Regardless of the methodology, psychological effects or well-being effects are difficult to measure as these effects are more subjective in nature. It must also be recognised that there are uncertainties in relation to assessing impacts on individuals due to availability of health data about individuals and the difficulty in predicting effects on individuals, which could be based on a variety of assumptions. Subsequently, the existing receiving environment and relevant health-based standards assessment are relied upon to arrive at conclusions relating to likely human health effects.

6.2.8.3 Identification of Vulnerable Groups

The population baseline characteristics or the community profile is required to inform the assessment of the proposed development on human health and this informs the identification of potential vulnerable groups in the environment. Children and adolescents constitute a vulnerable group as they lack the experience and judgement displayed by adults. Studies also show that they may be more sensitive than adults to noise and air pollution and other environmental impacts.

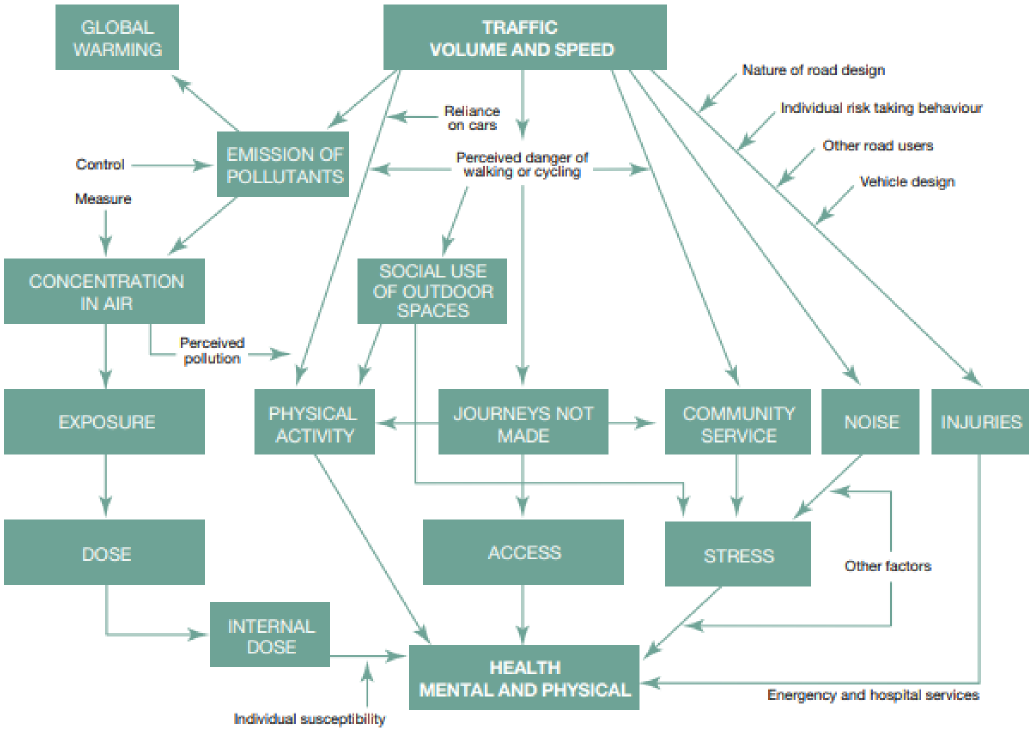
Older people also constitute a vulnerable group, but this can vary depending on a number of factors including level of income, education, deprivation and individual preferences or genetics. However, an assumption can be made that older populations move slower than their younger counterparts, particularly when moving around in traffic and public places. Older persons are also more vulnerable to health conditions occurring than their younger counterparts. Ease of access to medical and community facilities become very important in maintaining health and quality of life outcomes for all cohorts. Vulnerable groups in general have greater sensitivity to air pollution and potential effects on the respiratory system and cardiovascular system. There are many reasons for this including the possible presence of other medical conditions such as respiratory or cardiovascular disease. Some subtle changes in the environment have the potential to have an adverse effect that would not be experienced by a younger more resilient person. Other vulnerable groups also include the mobility impaired or psychologically ill.

6.2.8.4 Hazard Identification

Human health impacts related to transport infrastructure can arise as a result of a variety of factors and interactions across environmental receptors e.g. traffic accidents or safety issues, air and noise pollution, impacts on water quality, flooding, etc. which have the potential to cause a threat to the health of populations and the wider environment. Therefore, all aspects of the environment influence human health to some degree or another.

A literature review was performed and identified recognised health effects of road and bridge construction and operations on human health. Transport can affect health outcomes both directly and indirectly. For example, directly through air pollution or traffic accidents and indirectly, as a result of supporting an increase in car-based transport which in turn increases the fossil fuelled vehicles on roads, thereby increasing carbon emissions into the atmosphere and contributing to climate change.

Although somewhat outdated, the information contained in the Institute of Public Health (IPH) published *Health Impacts of Transport* (2005) is still relevant today where it analysed the pathways from transport to health, as presented in Plate 6.2. The main impacts can be summarised as: road traffic injuries, air pollution, noise pollution, effects on physical activity, effects on community (social networks, social capital on health) and social inclusion (effect on access and social inclusion).



Source: Joffe M and Mindell J.[13]

Plate 6.2 Pathways from transport policy to health outcomes (IPH, 2005)

A further literature review from similar projects elsewhere identifies that there are four main hazards to human health that can be classified under: physical, psychosocial, chemical and biological hazards and are summarised in Table 6.6.

Table 6.6 Four Main Hazards to Human Health

Physical Hazards	Psychosocial Hazards	Chemical Hazards	Biological Hazards
The main physical hazards identified are: • Noise (including nuisance/ disturbance, noise induced hearing impairment, interference with speech communication, sleep disturbance, hypertension and cardiovascular disease), • Vibration (including nuisance) • Air quality (including construction dust, carbon monoxide, fine particles, etc.), • Water quality (including effects due to contaminated land); • Soils (contamination of land); • Traffic – including collisions, injuries or worst-case fatalities); • Other physical hazards e.g. radon	The main hazards identified include: • Nuisance • Anti-social behaviour • Suicide	The main hazards identified include: • Heavy metals, • Contaminants.	The main biological hazards identified are: • Surface water and ground water (including water contamination) • Aspergillus (A fungi with potential for human health impacts) • Rodent-borne diseases e.g. Leptospirosis

6.2.8.5 *Impact of Emissions to Air*

Air quality is generally classified as good in Ireland. However, traffic is a key pressure on air quality and is the main cause of air quality problems in our larger towns and cities (EPA, 2016). Vehicles emit a range of air pollutants including nitrogen oxides (NOx), particulate matter (PM10 and PM2.5), black carbon and volatile organic compounds (VOCs) particularly present in urban areas and areas with high congestion levels. There are significant human health impacts from particulate matter (PM) and nitrogen oxides (NOx) emissions, which include cardiovascular disease, lung disease and heart attacks (EPA, 2015). The proposed development is restricted to pedestrians, cyclists and an electric bus service. Therefore, there is no predicted impact, adverse or beneficial on traffic emissions.

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU. In order to reduce the risk to health from poor air quality, National and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Chapter 13, Table 13.1 and Appendix 13.1 Ambient Air Quality Standards of this EIAR). Institute of Air Quality Management (IAQM) guidelines (IAQM 2014) for assessing the impact of dust emissions from construction and demolition activities based on the scale and nature of the works and the sensitivity of the area to dust impacts are the basis for the human health assessment.

6.2.8.6 *Impact of Noise and Vibration Emissions*

Noise is measured using the standard decibel scale (dBA). The "A" represents a weighting that mimics human hearing. It is important to note that because the decibel is a logarithmic scale i.e. non-linear scale, therefore the figure can be somewhat confusing. An increase in 3bdB means a doubling of the sound intensity in energy terms. However, the human ear does not normally perceive this degree of increase in volume. Normally, a 10dB increase in noise levels equates to a subjective doubling in audible sound.

According to the WHO, noise is the second greatest environmental cause of health problems, after air quality. Excessive noise can seriously harm human health, affect mental health and people's daily activities including in sensitive receptors such as residential properties, schools, workplace and during amenity or leisure time. EPA, 2016 states that "*noise can disturb sleep, cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour".*

EPA, 2016 also states that "*a study commissioned by the European Commission on the health implications of road, railway and aircraft noise in the European Union (RIVM, 2014) found that exposure to noise in Europe contributes to:*

- *about 910,000 additional prevalent cases of hypertension;*
- *43,000 hospital admissions per year;*
- *at least 10,000 premature deaths per year related to coronary heart disease and stroke*." (EPA, 2016)

The assessment and management of noise from the infrastructural transport sources (roads, rail, and airports) are governed by the Environmental Noise Directive and associated 2006 Environmental Noise Regulations (S.I. 140 of 2006).

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In lieu of statutory guidance, an assessment of significance has been undertaken as per British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 12.3 of Chapter 12 sets out the values which, when exceeded, signify a significant effect at the façades of residential receptors (replicated in Table 6.7).

Table 6.7 Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,\,T}$)		
	Category A[A]	Category B[B]	Category C[C]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings and weekends [D]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

[D] 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined through a logarithmic averaging of the measurements for each location and then rounded to the nearest 5dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur.

Table 6.8 presents the DMRB (2011) likely impacts associated with change in traffic noise level. The corresponding significance of impact presented in the '*EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EIAR), Draft, August 2017 is presented alongside this for consistency in wording and terminology for the assessment of impact significance.

Table 6.8 Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level DMRB, 2011 (dB L_{A10})	Subjective Reaction DMRB, 2011	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No change	None	Imperceptible
0.1 – 2.9	Barely perceptible	Minor	Not Significant
3.0 – 4.9	Noticeable	Moderate	Slight, Moderate

Change in Sound Level DMRB, 2011 (dB L_{A10})	Subjective Reaction DMRB, 2011	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIAR (EPA)
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial	Significant
10.0 or more	More than a doubling or halving of loudness	Major	Very Significant, Profound

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

What determines its significance is the amount of the exceedance. The other factor that needs to be considered is the baseline. If the change from the current baseline is 3dB or less, even if the absolute levels are above 55dB the change is likely to be imperceptible.

It is assumed that average noise levels in a building with windows open will be at least an estimated 15dB less than outside. Average sound inside a building with the windows closed can be greater than 35dB, depending on the building fabric. Accordingly, the attenuation can vary depending on the size of windows, building type and other factors. The potential health impacts due to noise include:

- Noise-Induced Hearing Impairment
- Interference with speech communication
- Disturbance at schools
- Sleep disturbance
- Hypertension and cardiovascular disease

In terms of the health effects of environmental noise there is some limited evidence of effects on blood pressure, cardiovascular risk, school performance and in relation to sleep disturbance. Any effects demonstrated are more likely at higher noise levels. Many effects are only demonstrated with ambient noise in excess of 70 dB. Whilst noise levels are often quoted with respect to potential effects on health and they are used in the significance assessment, it should be noted that the differences in significance between the different levels are relative rather than absolute.

6.2.8.7 Impact of Emissions to Hydrology and Hydrogeology

Emissions standards and pathways that affect human health relating to hydrology and hydrogeology include water quality and flood risk. From a human health perspective these pathways are discussed below.

Water quality

Construction and operational (fuel spillages, etc) activities pose a risk to watercourses, particularly contaminated surface water runoff from construction activities entering the watercourse. Impacts to sources of drinking water are also sensitive and should be considered as part human health issue in this context.

Flood Risk

Hydraulic structures such as bridges, culverts, channel diversions and outfalls can, if not appropriately designed, impact negatively on upstream water levels and downstream flows.

6.2.8.8 Impacts of Emissions to Soil

Consideration of likely emissions to and from a project relating to contamination of soil or the potential to uncover contaminated land based on previous land uses (e.g. landfill, industrial, manufacturing uses) have the potential to affect human health. During construction activities there is potential to unearth or uncover previously buried materials or contaminants and depending on the nature of the contamination may have the potential to effect human health if not appropriately addressed.

Radon is a naturally occurring radioactive gas that originates from the decay of uranium in rocks and soils. It is colourless, odourless and tasteless and can only be measured using special equipment. Radon rises up through the ground to disperse in the air and only becomes a health hazard when it is trapped in buildings.

6.2.8.9 Psychosocial Impacts

Consideration of likely negative psychosocial hazards relating to the new developments include; nuisance, anti-social behaviour and suicide. On the contrary, there could also be positive psychosocial impacts on the community due to improved connectivity particularly for pedestrians and cyclists and as a result of regeneration associated with landuse changes and increased economic prosperity. Due to the subjectivity relating to psychosocial effects it is not possible to use a standard based approach in this assessment.

Demolition and property acquisition can also have impact on both the occupants themselves but also at community level due to impact on community ties and amenity of residents, local economy, etc.

6.3 Description of the Receiving Environment

6.3.1 Introduction

The proposed 5-span, 8m wide opening bridge will accommodate pedestrians, cyclists and an electric shuttle bus service. The bridge is also locally widened in two locations to facilitate repose and look out areas. Cyclists and the electric shuttle bus will be facilitated through a shared-space lane, whilst pedestrians will be provided with a primarily segregated area of the deck cross-section. There are some locations at the centre of the span and the south plaza where all the spaces are shared spaces between pedestrians, cyclists and the electric bus.

The proposed development also comprises a new plaza at the South Quay landing point. This plaza will be a paved and landscaped space. There will also be lighting, flagpoles, street furniture and planting which will be subject to detailed design and is indicatively illustrated as presented in Plate 4.2 of Chapter 4 of this EIAR. A mechanical control building is located in the new plaza area. The foundations and utility provisions of two future buildings are included in this Environmental Assessment Impact Report, but the buildings about ground level are not included in this assessment and will be the subject of a future planning application.

The proposed bridge across the River Suir will be a public amenity offering greater appreciation and enjoyment of the river. In order to develop a transport facility that will permit and encourage sustainable development, a user hierarchy of pedestrians, cyclists and an electric shuttle bus service will be adopted. The bus is expected to run every 20 minutes during day time hours. The bus is likely to have a capacity of approximately 15 people. Private cars will not be accommodated as part of the proposed development. The proposed bridge will be a sustainable transport bridge that connects into the existing road infrastructure in a logical and safe manner.

A temporary site compound site will be required in the vicinity of the development. For the purposes of this assessment it is assumed to be located in the vicinity of the South quays. For the purpose of this assessment, a site compound is envisaged to be located on the South Quay, to the west and east of the Clock Tower, where the contractor can have a direct access to the site. The construction phase is likely to last approximately 18-24 months. A description of all elements of the proposed development and likely construction sequence is provided in Chapter 4 of this EIAR.

The following paragraphs present an overview of the context, character, significance of the receiving environment and identifies the types of population and human health receptors that could be considered sensitive to the proposed development within the study area.

Context

The proposed development is located in Waterford City centre and will connect the existing city centre (south of the River) with the north of the city particularly the designated NQ SDZ and residential areas located in the Ferrybank area. This SDZ area is expected to become "*A regeneration catalyst for the City and Region and the establishment of a sustainable modern city quarter"* (NQ SDZ Planning Scheme 2018). Once developed, the area will see a "*sustainable, compact extension to the City Centre that will serve the future population of 83,000"*. An integrated multi-modal transport hub is also planned to be developed along the Dock Road and the proposed development will create the necessary physical connection between these new areas (commercial and residential areas) and existing urban quarters. It will also connect the south of the city with the suburban residential areas located in the northern environs of the city. The proposed development is consistent with the planning policy of the Waterford City Development Plan 2013-2019 which includes an objective for a bridge crossing of the River Suir and also to provide development opportunities on the north of the city.

Character

Waterford City has a rich, historical and maritime past. Waterford City has a strong historical urban centre, rich in architectural heritage and supports a range of commercial and mixed-use developments serving the City and south east region population. The River Suir still influences the character of the city with national and international boats berthed on the six pontoons that line the south quays year-round. Meagher's Quay on the south of the River Suir is the location of the southern landing of the proposed bridge and is also the location of extensive carparking area servicing the everyday carparking needs of people working and/ or visiting the City. The main road access to the city centre is via the R680 over Rice Bridge (a protected structure) and along the south quays. The traffic on this main thoroughfare influences the character of the south quays which is often congested.

The south quays retain some historic street furniture in the form of public lighting stands and an industrial crane which was once associated with port activities. However contemporary street furniture is highly varied and cluttered, especially around the entrances to the aforementioned carparks.

The early 19th and 20th Century industrial and port related buildings located on the North Quays have recently been demolished and the area is now a brownfield site awaiting redevelopment. Ferrybank is located to the north, adjacent to the SDZ area and located at an elevated height from the rest of the city. It is characterised by suburban residential areas with a village core containing neighbourhood facilities, educational and amenity services.

Significance

Waterford City is the key city in the south east region and the National Planning Framework (NPF) focuses on supporting its continued growth and development. The NPF supports ambitious growth targets to enable Waterford City along with Cork, Limerick and Galway to grow by at least 50% to 2040 and to enhance their significant potential to become cities of scale.

The NQ received Ministerial designation as an SDZ in 2016 with the State stating that it is of "*economic and social importance to the State*".[1] Therefore this area is deemed to be a significant area in both national, regional and local context. The NQ SDZ Planning Scheme was approved by WCCC in February 2018 and is awaiting redevelopment.

The south quays areas, city centre and the marinas located on the River Suir have a dominant and significant land use and economic function for the City and region.

Sensitivity

In terms of landuse sensitivity, the city has a wide selection of residential, community, leisure, tourism, sports and recreational facilities which are the most sensitive receptors to change. There are a number of schools, childcare facilities/ créches, sports grounds, libraries and community centres located in the vicinity listed in Section 6.3.2.7 Community Infrastructure including amenities, employment and education facilities mapped on Figure 6.1 of Volume 3 of this EIAR.

Sensitive receptors present in the immediate study area (within 500m) on the south of the city include: Waterford Marina and search and rescue emergency services operating from the River Suir. The Clock Tower, Hotels (Granville Hotel, Dooley's Hotel), Waterford Bus Station and bus stops, banking services, shops, petrol station, a range of retail and commercial units, tourism facilities and services operate along the south quays and in the wider city centre area.

Sensitive receptors present on the north of the city (within 500m) include a number of residential areas associated with the Ferrybank neighbourhood, Plunkett Railway Station, Abbey Community College, Ferrybank Secondary School, Saint Joseph's Home, Our Lady of Good Counsel, Power's Funeral Directors and a range of neighbourhood facilities including shops, pharmacy, restaurants and a petrol station. Waterford golf club is located 500m of the proposed development.

Other examples of sensitive community facilities in the wider 1km study area include: a range of medical, religious and cultural and institutions, leisure centres, gyms, GAA, rugby and soccer clubs. Waterford City has rich tourism and amenity offer including historical sites in the city, nature walks and tours along the River Suir and surrounding landscape. The city has many supporting services including hotels, hostels, café, restaurants, etc. Due to the urban location and mixed-use city centre nature of the

[1] Government of Ireland. 2016. *S.I. No. 30 of 2016, Planning and Development Act 2000 (Designation of Strategic Development Zone: North Quays, Waterford City) Order 2016.*

area, populations in these areas are considered to be more adaptable and less sensitive to change than their rural counterparts.

The River Suir serves an important function from an amenity, recreation and well-being perspective for city dwellers and visitors alike. It is currently used as a river walk and is deemed to be a sensitive natural and ecological resource. It is sensitive from an amenity, landscape and visual perspective along with from a cultural heritage perspective as the South quays are designated as an Architectural Conservation Area (ACA). Tourism is a significant contributor to the region and local economy.

There has been a consistent decline in unemployment rates in the South East region which is a good indicator of increasing economic activity. However, Waterford City unemployment rates are improving but are still high (18.8% when compared with the State 12.9%) Census 2016. In terms of demographics, Waterford City has a very young and ageing population, and both of these cohorts are considered to be vulnerable from a health perspective. The HP Pobal deprivation scores (Table 6.15) indicate that the majority of the study area is either 'marginally below average' affluence or 'disadvantaged'. This data is particularly useful in assessing predicted health outcomes. Also, historically, a number of the EDs within the study area have been targeted for investment and revitalisation.

A more detailed description of the baseline environment including sensitivities is presented under the following sections to include.

- Land use and Social considerations: including and population, deprivation levels, age profile, amenity and community infrastructure;
- Economic Activity including tourism; and
- Human health aspects.

6.3.2 Land Use and Social Considerations

Successive planning and transport plans have emphasised the need to regenerate the North Quays, revitalise the city centre and improve the physical connection between the North and south quays including the provision of a pedestrian bridge. Current planning policy seeks to create a vibrant city centre and link the various distinct urban quarters in the city to the planned new NQ SDZ quarter including residential, commercial and high-quality transport and public realm infrastructure. The latest translation of this planning policy is the adoption of the NQ SDZ Planning Scheme in 2018. The site of the proposed development is located in three distinct areas:

- The River Suir is a navigation channel and is the location of the Waterford City Marina. It is a source of ecological, recreation, amenity and economic value;
- The south quays (Meagher's Quay). Location of city centre carparking, south quays flood defence structures and source of amenity for city dwellers. Waterford Bus Station is also located on the south quays and associated bus stops and waiting areas; and
- The North Quays: Currently a vacant brownfield site awaiting regeneration in accordance with the NQ SDZ Planning Scheme.

6.3.2.1 NQ SDZ Planning Scheme (2018)

The NQ SDZ Planning Scheme was adopted by elected members in February 2018. The Vision for the area is to provide for the development of the sustainable, mixed use, modern compact extension to the city centre and a regeneration catalyst for the city that includes a multi modal transport hub. The type and extent of future development is detailed in the Planning Scheme and includes retail (comparison), food and beverage, office, hotel and conference centre, tourism/ cultural/ enterprise/light industry/community facilities and residential as detailed in Table **6.7** 6.9.

Table 6.9 Extent of Development, as Set Out in the NQ SDZ Planning Scheme

Land Use	Minimum Net Floor Area	Maximum Net Floor Area
Retail (Comparison)	20,000sqm	30,000sqm
Food and Beverage	5,000sqm	7,000sqm
Office	10,000sqm	15,000sqm
Hotel and Conference Centre	10,000sqm	15,000sqm
Tourism / Cultural / Enterprise / Light Industry / Community Facilities	10,000sqm	15,000sqm
Residential	200 units	300 units
Note: Allow for up to 20% of office or retail floor space to be re allocated for residential development if the market place so demands.		

Plate 6.3 illustrates the transport hub and access strategy provisions required to support the SDZ which includes the development of a bridge over the River Suir, the relocation of the train station including bus station, pick-up and drop-off locations. As can be seen from Plate 6.3 the bridge is critical to improving the connectivity of the NQ SDZ with the rest of the Waterford City centre and connectivity with existing and planned greenroutes including the Waterford to New Ross Greenway.

Plate 6.3 Transport Hub and Access Strategy (Source NQ SDZ Planning Scheme)

6.3.2.2 Population

Census 2016 reports that there was a total population of 48,216 persons in County Waterford City. Waterford City and Suburbs had a population of 53,504. The population of Waterford City and suburbs increased by 3.85% between 2011 and 2016 which is largely in line with the population growth of the State.

The proposed development is located in the two Electoral Divisions (EDs) (Ferrybank and Centre A). In 2016 census, the total combined population residing within these

EDs was 1,649 persons. Nobody currently resides on the NQ SDZ, however there are a number of residential properties along the Dock Road that are located within close proximity to the proposed development. The Ferrybank ED reported a 53 person decline (-5.3%) between 2011 and 2016 with a total of 858 persons residing there in 2016. In contrast, Centre A increased by 15% to a total of 791 persons over the same period. Both EDs have relatively low levels of populations for urban environments reflecting that these areas are currently not significant residential areas in the city.

There have been consistent increases in the population of Waterford City in the Study area expect for in the Ferrybank area which has experienced consistent population decline as detailed in Table 6.10. The population in County Waterford is higher than in the City – a trend similar to other Counties across Ireland however the County it has been experiencing a decline in population since the last census period which could be attributed to the economic decline and subsequent migration patterns to urban areas across Ireland or abroad.

Table 6.10 Population Change in the Study area by Electoral Division, City and County (Census, 2016, 2011)

Study Area (500m) Electoral District	**Population 2016**	**Population 2011**	**% change 2011-2016**
Ferrybank	858	911	-5.8
Centre A	791	679	16.5
Kilculliheen	5246	4811	9.0
Centre B	236	233	1.3
Custom House A	353	287	23.0
Custom House B	269	213	26.3
The Glen	742	566	31.1
Ballybricken	145	130	11.5
Shortcourse	301	274	9.9
Mount Sion	849	747	13.7
EDs within 1km Study Area	**Population 2016**	**Population 2011**	**% change 2011-2016**
Bilberry	802	718	
Kingsmeadow	1093	1106	-1.2
Military Road	763	821	-7.1
Morrison's Avenue East	510	560	-8.9
Morrison's Road	490	508	-3.5
Newport's Square	543	556	-2.3
Park	1520	1382	10.0
Poleberry	1357	1055	28.6
Roanmore	812	814	-0.2
Slievekeale	593	592	0.2
Waterford City	**48,216**	**46,732**	**3.17**
Waterford County	**67.960**	**69,444**	**-2.14**

6.3.2.3 Age profile and dependency ratio

Waterford City has a young population profile relative to the national average as can be seen from the age profile graph in Plate 6.4. The majority of the population in

Waterford is between the 20 to 39 years age group cohorts. The largest cohort is 35-39 reflecting the last 'baby boom' of the early 1980s. The age profiles illustrate the large increase in fertility (birth) rates and increase in the number of older (over 65+) population reflective of the national trend whereby people are living longer.

Age dependency ratio is the population ratio of those typically not in the labour force (0-14 and 65+) and those typically in the labour force (15-64). It indicates the pressure on the productive population to support services for younger and older age cohorts of the population. The age profile indicates that there is a high older dependency ratio across the study area with 16% of the population 65 years of age or over. The average age dependency ratio for the study area is very high at 31.30. This figure indicates that there is currently pressure on the population and a higher potential for pressure to occur on productive population to support the younger and older age cohorts now and into the future. This will also have pressure on landuse and services to support the changing needs of the population over time such as medical care, social, education and community services.

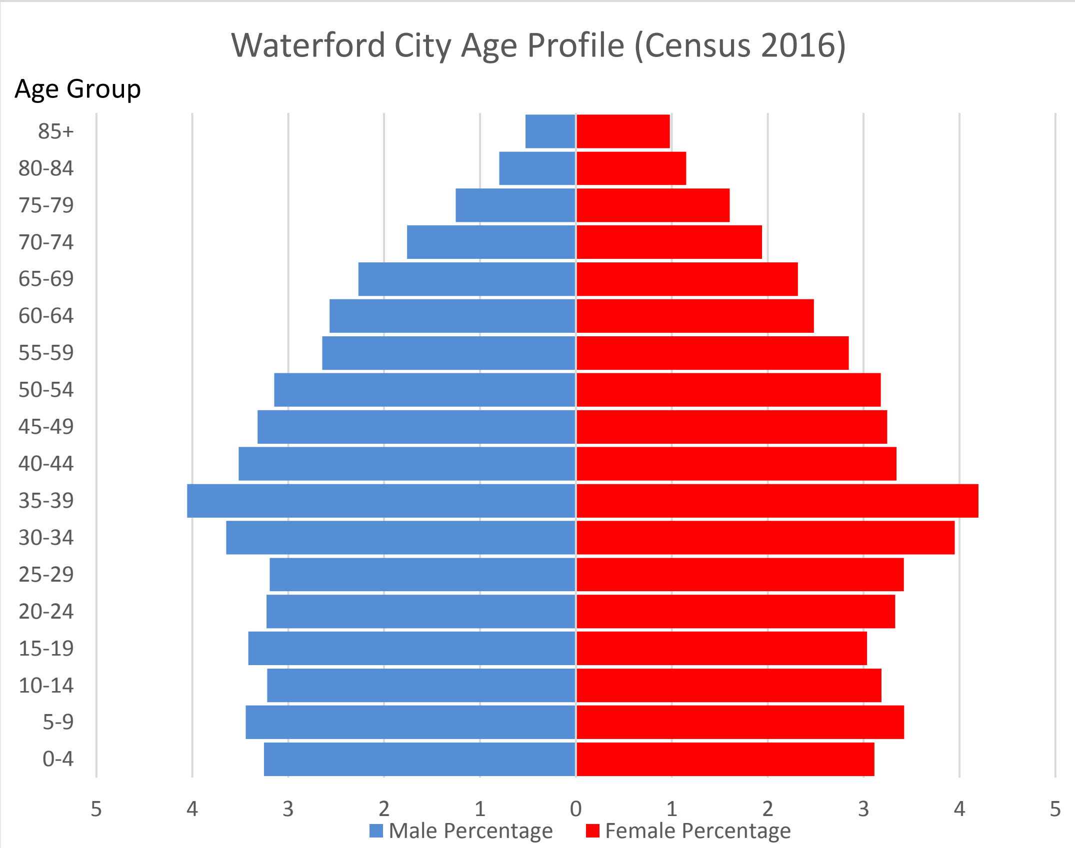


Plate 6.4 Waterford City Age Profile

6.3.2.4 Households and household formation

In 2016, there were 18,958 households in Waterford City with 8,066 within the study area. Waterford City largely comprises 1 or 2 person households with the next biggest category being 4 and 3 person households respectively. There is approximately 20% of the population in the study area in local authority rented accommodation.

6.3.2.5 Education

Education levels have greatly improved across Ireland, particularly over the last two decades. In 2016 42% of people in the State had a third level education compared with 13.6% in 1991. Waterford City census 2016 report 12,801 persons attained a secondary education, 7,944 attainted a third level education (bachelor's degree or over) and 4,073 had a primary education. An additional 6,570 persons attained a technical, vocational or advanced higher certificate/ apprenticeship. 607 people had no formal education.

6.3.2.6 Travel to work, school or college

Census 2016 results for primary means of travel to work, school or college for Waterford City and Suburbs is set down in Table 6.11. Census figures show the majority of population travels either by 'car driver' or 'car passenger' with a combined total of 21,214 people. The second largest mode of transport is by foot with a total of 6,000 people walking. Cycling is not as popular as walking with only 520 people using the bicycle as their primary means of travelling to work, school or college.

Table 6.11 Population aged 5 years and over by means of travel to work, school or college Waterford City and Suburbs (Census 2016)

Means of Travel	Work	School or College	Total
Car driver	12,557	670	13,227
Car passenger	1,549	6,438	7,987
On foot	2,632	3,368	6,000
Not stated	1,155	669	1,824
Bus, minibus or coach	501	866	1,367
Van	823	17	840
Work mainly at or from home	522	6	528
Bicycle	399	121	520
Motorcycle or scooter	78	12	90
Train, DART or LUAS	53	22	75
Other (incl. lorry)	43	2	45
Total	**20,312**	**12,191**	**32,503**

Census 2016 also reports on the travel time and indicates that the majority (13,715) of people within Waterford City and Suburbs travel under 15 minutes to work, school or college. This would Census also reports that most people leave home between the hours of 08.01-08.30 (8,136) and 8.31-9.00 (7,984) as presented in Table 6.12. These times would correspond with the increase in traffic conditions/ congestions patterns witnessed during site visits along the south quays during these periods. More details on traffic movements in the area can be found in Chapter 5 of this EIAR. Analysis of transport patterns shows that pedestrian and cyclist connectivity between the North Quays area and Waterford City Centre is poor.

Table 6.12 Population aged 5 years and over by time leaving home to travel to work, school or college Waterford City and Suburbs (Census 2016)

Time Leaving Home	Persons
Before 06:30	1,927
06:30-07:00	1,601
07:01-07:30	1,855
07:31-08:00	3,916
08:01-08:30	8,136

Time Leaving Home	Persons
08:31-09:00	7,984
09:01-09:30	1,866
After 09:30	2,643
Not stated	2,047
Total	**31,975**

6.3.2.7 Community Infrastructure

Community infrastructure is far reaching and can include a range of physical, social and economic infrastructure. Community infrastructure includes places where people can relax and enjoy public spaces such as parks or the various seating areas located along the south quays. There are a wide range of community and social services available in Waterford City and its environs. These include education and religious facilities including, primary, secondary and third level, places of worship, community centres. Community facilities include parks, sports grounds and other sports and youth centres/ clubs that are located across the study area. All of these community facilities are considered to be significant and sensitive receptors within the study area.

There is a garda station in the City and in the Ferrybank area, post offices and various post boxes throughout the city, libraries, the City Hall and the newly refurbished courthouse. There are also a number of public spaces throughout the city in the study area including William Vincent Wallace Plaza located on the south quays, the Peoples Park, Ballybricken Green and Red Square. The recently refurbished Apple Market is key public space which is also located in the study area.

Education facilities

Educational facilities are a significant local and regional resource and are considered sensitive receptors. Waterford City has a range of education facilities from early education (créches) to third level. Waterford Institute of Technology (WIT) is a significant education facility in the city and region. WIT is located approximately 2.5km south west of the study area and has approximately 10,000 students. A large number of educational facilities are present within the study area. They are split between north and south of the river to include:

North of the River Suir:

- Abbey Community College and Ferrybank Secondary School; and
- St. Mary's Boy School.

South of the River Suir:

- St. Stephen's De La Salle Primary School;
- St. Joseph's Special School;
- Mount Sion CBS Secondary School;
- Mount Sion Primary School;
- Calvary School of Ministry;
- Our Lady of Mercy Secondary School;
- Our Lady of Mercy Senior National School;
- Presentation Primary and Secondary School;
- St. Declan's National School;

- Christchurch National School;
- Waterpark, De La Salle College;
- Newtown School;
- St. John of God, Newtown Junior School;
- Christchurch National School; and
- Waterford College of Further Education

There are also a number of childcare facilities and creches in the area including but not limited to: Bumble Bees Creche & Playgroup, FerryFun childcare and Afterschool centre, Jeanes Montessori school, Mercy Preschool Ltd., Mount Sion play/preschool, Nurture and Grow, Play Together, St Brigid's Children's Centre, St Declan's pre-school, St Joseph's Childcare Centre, St Stephens Preschool, The Children's House Montessori School, Waterford Montessori school, Waterford Women's Centre Childcare Service. Ferrybank Library is located to the north of the city and Waterford City and County library is located on Lady Lane in the south of the city centre. Other sensitive community services within close proximity include Powers Funeral Directors and Powers Monumental Works located on Abbey Road, Ferrybank.

Transport infrastructure

Transport services are also important community facilities and include Plunkett Railway Station located adjacent to Rice Bridge on Dock road. Waterford Bus Station is located on Merchants Quay. The proposed Waterford to New Ross Greenway is located on the north of the River.

Marine based community infrastructure

The River Suir serves an amenity function as well as a transport corridor. It is also the location for a number of marine based community services including Waterford City River Rescue and Waterford Marine Search and Rescue (WMSAR) both of which operate east of the proposed development. Both organisations operate on a voluntary basis and are non-profit organisations and provide 24 hour a day, 365 days per year search and rescue services on the River Suir.

Waterford City River Suir Rescue base is at the Millennium Plaza (approximately 300m downstream of the proposed development) and is a member of the Community Rescue Boats of Ireland (CRBI) and affiliated to the Irish Coast Guard.

WMSAR is based further downstream (approximately 1km east from the proposed development) and is also a part of the CRBI and conducts suicide prevention night patrols along Waterford City's quaysides, participates in search and rescue, maintains and monitors ring-buoys among other activities. They are also an official Irish Sailing Association (ISA) training centre.

6.3.3 Economic Activity

The South East region generates 8% of the national Gross Domestic Product (GDP), estimated to be €19.9billion[2]. There has been an overall decline in unemployment rates over the past number of years in the South East region which is a good indicator of economic activity. The following sections include a review of employment and key industries, unemployment rates and a review of commercial, retail and tourism activity in the area.

[2] Waterford Institute of Technology. 2017. *South East Economic Monitor*

6.3.3.1 Employment

The labour force consists of those who are able to work i.e. those aged 15 and over and out of full-time education. There was 91,631 persons at work in Waterford City and County in 2016 (census 2016), representing an increase of 2,416 persons recorded as working since the 2011 census. Table 6.13 provides a breakdown of the population employed in Waterford City and Suburbs at work by socio-economic group. The majority of the City's workforce (22%) are engaged in work under 'gainfully occupied and unknown', followed closely by 'non-manual' and then 'semi-skilled manual'.

Table 6.13 Persons in private households by socio-economic group Waterford City and Suburbs (census 2016)

Socio-economic group of reference person	Households	Persons
Z All others gainfully occupied and unknown	4,855	10,719
D Non-manual	4,174	10,629
F Semi-skilled	2,282	6,086
A Employers and managers	2,142	5,867
E Manual skilled	2,188	5,503
C Lower professional	2,041	5,197
B Higher professional	1,133	3,071
G Unskilled	1,247	2,908
H Own account workers	673	1,892
I Farmers	55	141
J Agricultural workers	23	56
Total	**20,813**	**52,069**

Persons at work by industry and sex in Waterford City and suburbs is presented in Table 6.14 from census 2016. These figures indicate that the majority of the workforce in the City and suburbs are engaged in professional services industry (5,476), the second largest industry is commerce and trade sector (4,510), with 'other' industry engaging 4,126 persons, followed by manufacturing industry (3,614) with a larger portion of this group involving males (2,592). Only 738 persons are employed in the building and construction industry which would be likely to increase with the proposed development and also the wider regeneration presented as a result of the NQ SDZ Planning Scheme.

Table 6.14 Persons at work by industry and sex Waterford City & suburbs (census 2016)

Industry	Male	Female	Total
Professional services	1,714	3,762	5,476
Commerce and trade	2,236	2,274	4,510
Other	2,046	2,080	4,126
Manufacturing industries	2,592	1,022	3,614
Transport and communications	946	300	1,246
Public administration	413	360	773
Building and construction	688	50	738
Agriculture, forestry and fishing	105	26	131
Total	**10,740**	**9,874**	**20,614**

6.3.3.2 Unemployment

Census 2016 reports the average rate of unemployment in the State was 12.9%. Waterford City including its suburbs had the highest unemployment rate at 18.8% during this period. In June 2018, Waterford County had the greatest number of people on the live register with 8,201 persons, closely followed by Waterford City, 7,000 persons. Kilkenny City and county were much lower at 3,676 and 3,023 persons respectively.

6.3.3.3 Transport Infrastructure

There is extensive at-grade car parking extending from Merchants Quay east to Clyde Wharf that is operated by Q-Park. Other car parks in the city include: IPairc city square (on High street), Bolton Street car park, Ipairc Apple Market carpark, waterside car park, IPairc Railway Square car park and Thomas Hill car park.

Outside of the study area significant economic and transport activity includes: Waterford Airport (approximately 8.5km south) and the Port of Waterford located at Bellview Port and associated Industrial area that are sources of major economic activity, transport and trade. The road network is also important transport and economic infrastructure and includes many local, regional and national roads including, M9 to Dublin and N25 Cork to Rosslare Europort via Waterford and N24 national primary route serving Limerick to Waterford through Tipperary all located approximately 3km north west of the site.

6.3.3.4 Marine Based Economic Activities

There is significant marine based transport and economic activity on the River Suir. The marina to the west of the proposed development (Pontoon D) is owned and operated by Port of Waterford Company, currently leased to a private operator. The economic activities associated with the Port is located downstream at Bellview Port.

Waterford City Marina is located on the south side of the River Suir (within the site of the proposed development) and extends for approximately 650m east along the south quays. River Suir Cruises offer cruises of the River for tourism and amenity purposes and operate from Pontoon C (referred hereafter as the existing floating jetty). There are also occasional cruise ship and fishing vessels that berth in the area.

Fastnet Shipping Ltd. and South East Tugs, two commercial companies, operate upstream (west) of the proposed development and regularly use the River Suir channel.

The area is included in an International Ship and Port Facility Security Code (ISPS) which permits any ship to berth in this area. The International Maritime Organization (IMO) states that the ISPS code is a comprehensive set of measures to enhance the security of ships and port facilities, developed in response to the perceived threats to ships and port facilities in the wake of the 9/11.

6.3.3.5 Retail Activity

Waterford City has significant commercial and retail activity. There are several retail shopping locations, primarily in the south of the city and within the study area to include: Georges Shopping Centre and City Square Shopping Centre. The retail streets of Barronstrand Street, Broad Street and New Street are also important city centre retail and commercial areas along with Michael Street and Merchant's Quay. Economic activity on the south quays include a number of hotels, restaurants, leisure facilities, retail, financial services including banking and accounting and other professional services.

The Economic Strategy for Waterford City and County stated that in 2013 "*Waterford has an estimated catchment of 250,000 people [and] estimates indicate that aggregate retail sales in the City currently amount to €287 million (convenience) and €393 million (comparison[3]) per annum*."[4] The current comparison retail offer is weak when compared with Waterford's main competitors. Both comparison scenarios considered in the Retail Strategy estimated the level of trade draw and retention of comparison expenditure within the city area will increase within the timeframe of the Strategy in line with improvements to the retail offer. It is likely that the proposed development will facilitate improved access to the NQ SDZ which is earmarked for significant retail development and as such will facilitate the growth in Waterford's retail offer and economic activity.

The Waterford City Retail Strategy Update (2018d) household survey found that "*approximately 92% of comparison goods expenditure in Waterford City is retained by the City Centre area and attracts a further 90% of comparison expenditure from the 0-30 minute drivetime isochrone and 52% from the 30-45 minute isochrone. The survey identifies an inflow of 8% of comparison expenditure from the 45-60-minute drivetime.*

6.3.3.6 Tourism Amenities

Tourism is a significant contributor to the region and local economy. In 2017, over 954,000 overseas visitors came to the South East region (Carlow, Kilkenny, Tipperary (South), Waterford, Wexford) generating €272 million in revenue[5]. Fáilte Ireland 2017 Tourism Facts report that the South East was the fourth most popular location for domestic trips in Ireland with over 1,374,000 domestic visitors travelling to the region generating €253 million revenue. Waterford City is located in 'Ireland's Ancient East' a marketing initiative developed by Fáilte Ireland which includes improved transport signage across Ireland to increase visitor numbers to Ireland's living culture and ancient heritage across Ireland.

A review of tourism related locations, community amenities and recreation facilities within the study area indicates that Waterford City has rich tourism and amenity offer including historical sites located in the heart of the city, nature walks and tours along the River Suir and surrounding area. The city has many support services including hotels, hostels, café, restaurants, tourist office, Theatre Royal, Edmund Rice centre, Garter Lane Theatre, etc. that would be considered to be significant and sensitive receptors. The Clock Tower is a significant and sensitive landmark feature along the historic south quays streetscape, located adjacent to the proposed development in the vicinity of the proposed south quays public plaza.

There is an amenity walkway along the existing flood defence wall on the south quays with a number of accesses points (gangways) to the various pontoons associated with Waterford City Marina.

The Waterford City to Dungarvan greenway has resulted in an increase in the number of visitors to Waterford City and the surrounding areas since its official opening in March 2017. Waterford City Council reported that a total of 247,545 people used the greenway, of which 105,639 of this were on foot while 141,906 travelled by bike in 2017.

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[3] Comparison goods include clothing/footwear, medial/ pharmaceutical, newsagents/ bookshops and bulky goods/ electronical equipment to include furniture, household appliances, tools/ equipment for household or gardens, small-scale hardware and, recreation and leisure products.

[4]Economic Strategy for Waterford City and County (2013) DKM Economic Consultants, Colliers Int. & Brady Shipman Martin

[5]Tourism Facts 2017 Preliminary, May 2018, Fáilte Ireland

In the wider study area other sites of interest include: The Waterford Viking Triangle which is part of the 'cultural quarter' in the City and includes Reginald's Tower (containing the Viking museum), Waterford Treasures Medieval Museum and Bishop's Palace. Waterford Crystal is located on The Mall close by where guided tours are available. The Granary is also a site of interest on Merchant's Quay.

6.3.3.7 Marine related tourism activities

The River Suir is a significant tourism attraction, source of recreation and general amenity source for the city, mariners and its many tourists. Direct access to the River Suir from the city is via the Waterford Marina, which comprises six pontoons. All six pontoons have pedestrian gangways access points to the south quays. These accesses are located from east to west: Georges Quays and off Canada Street/ Canada Square, Adelphi Quay and Customs House Parade (beside William Vincent Wallace Plaza). Meagher's Quay (adjacent to the Clock Tower and the proposed development) and Merchants Quay. There is also some private mooring located off Adelphi Quay. Georges Quay is also the location of Waterford Marina building.

The marina is fully serviced, open year-round with approximately 100 berths available. Mariners can avail of daily, weekly or seasonal rates. Access to the marina is by means of a mobile phone operated Global System for Mobile (GSM) communication system.

The existing floating jetty is located within the proposed development construction area, operated by Waterford City and County Council. River Suir Cruises operate from this jetty and offer tours along the River Suir year-round.

Consultation with the marina operators indicate that the marina is generally at capacity during peak summer months and on average 70% occupied at all other times of the year. The users of the marina comprise a significant proportion of local berth holders and visitors from Europe many of whom are from the United Kingdom including Milford Haven east of Waterford City in South Wales. Visiting boats generally stay up to 2 or 3 nights in the marina and have economic benefits to the wider City.

6.3.4 Health Profile

The majority of Waterford City reported that their health was either very good (56%) or good (29%) representing a total of 45,562 people (Census, 2016). 1.7% stated that their health was bad and 0.4% stated it was very bad (190 people). Census 2016 also reports that there were 8,333 people or 18% of the population with a disability in Waterford City. The number of carers was 2,114 persons. Types of disabilities can vary to include: physical disabilities, vision impairment. deaf or hard of hearing, mental health conditions and intellectual disability, etc.

The average lone parent ratio for the study area was 40.0 in 2016 (Pobal, 2016). The Lenus health profile for Waterford City published in 2015 (HSE, 2016) was also consulted and reports that Waterford City had the 3rd highest percentage of lone parent households of 13.5% in the State compared to the national rate of 10.9%.

Cancer incidence rates in Waterford City and County are average or below average for all cancers, except for male malignant melanomas and male lung cancer which has the highest rate nationally (City & County data 2015). Waterford City and County has average or below average death rates for all causes, except deaths due to cancers which are above the national average.

According to the WHO one in four people experience mental health problems at some time in their lives. Suicide is a significant public health concern nationwide. As part of addressing this issue the *Waterford City and County Suicide Prevention Action Plan 2017-2020* has been developed. Mental health and self-harm statistics indicate that Waterford City had a slightly above average rate of suicide at 11.6% when compared with the national average being 11.3% between the 2007-2013 period (HSE, *Lenus Health Profile*, 2015). The latest CSO figures for suicide are from 2014, these figures indicate that there were 486 deaths by suicide nationally. Waterford City reported 1 death by suicide. County Waterford reported 12 deaths by suicide. Suicide rates remain high, particularly amongst young people and at-risk groups. The levels of deprivation within Waterford City are high in comparison with the rest of the State and therefore could increase the potential 'at risk' group in this area.

6.3.4.1 Levels of deprivation

The Haase and Pratschke (HP) deprivation index looks at geographical areas in order to measure the relative affluence or disadvantage of a particular geographical area. These are compiled from various census under 10 key indicators including: the proportion of skilled professionals, education levels, employment levels, and single-parent households found in an area. This data is particularly useful in assessing predicted health outcomes.

Overall the south east region is the second most disadvantaged region of Ireland and Waterford City is the second most disadvantaged area within the region. Analysis of census statistics together with Pobal data indicate that Waterford City South is the third most disadvantaged local electoral areas in the State with a deprivation score of -9.4 after Cork City West (-12) followed by Glenties (-10.6)[6].

The HP Pobal deprivation scores (Table 6.15) indicate that the majority of the study area is either 'marginally below average' affluence or 'disadvantaged'. Morisson's Road ED has a HP deprivation score of -20.32, 'very disadvantaged'. In contrast, the Park ED ranked the least deprived of all the areas in the study area but is still scored 'marginally below average'. The combined HP Index deprivation score of the study area is -6.03.

Table 6.15 HP Pobal Deprivation Scores in the Study Area

ED's within 500m Study Area	Deprivation Score 2016	Deprivation Description
Ferrybank	-10.98	disadvantaged
Centre A	-2.49	marginally below average
Kilculliheen	-0.17	marginally below average
Centre B	-10.28	marginally below average
Custom House A	-4.98	marginally below average
Custom House B	-5.20	marginally below average
The Glen	-4.61	marginally below average
Ballybricken	-9.71	marginally below average
Shortcourse	-14.32	disadvantaged
Mount Sion	-8.39	marginally below average
EDs within 1km Study Area		
Bilberry	2.15	marginally below average

[6]Trust Hasse & Jonathan Pratschke (2017) The 2016 Pobal HP Deprivation Index For Small Areas

ED's within 500m Study Area	Deprivation Score 2016	Deprivation Description
Kingsmedow	-15.34	disadvantaged
Military Road	-13.23	disadvantaged
Morrison's Avenue East	-10.22	disadvantaged
Morrison's Road	-20.32	very disadvantaged
Newport's Square	-18.57	disadvantaged
Park	0.33	marginally above average
Poleberry	-2.47	marginally below average
Roanmore	-14.75	disadvantaged
Slievekeale	-12.24	disadvantaged
Waterford City	**-9.2**	marginally below average
Waterford County	**-4.6**	marginally below average
Source: Census 2016 and Pobal		

Historically, a number of the EDs within the study area have been targeted for investment and revitalisation through the Waterford RAPID programme which was recast in 2017 to become the Community Enhancement Programme (CEP). Other programmes such as the Social Inclusion and Community Activation Programme (SICAP) aims to reduce poverty and promote social inclusion and equality. SICAP in the study area is overseen and managed by the Local Community Development Companies operating in the area namely, Waterford Area Partnership and County Kilkenny Leader. The proposed development and associated redevelopment of the NQ SDZ will provide a range of employment opportunities both during construction and operational phases for these and other communities in Waterford City and County.

6.3.4.2 Collisions Statistics

The Road Safety Authority reports on collisions across Ireland. Plate 6.5 illustrates road collision from 2005 to 2014 across all modes of transport (pedestrian, bicycle, motorcycle, car, goods vehicles, bus and other). This information shows that there has been a high level of collisions occurring across the study area particularly along the south quays and on Rice Bridge.

Four fatal collisions have occurred in the study area. One of these fatalities occurred in 2011 and involved a pedestrian on the south quays, close to the junction with Exchange Street, east of the proposed development.

Two other serious pedestrian collisions occurred along the south quays in 2008 and 2006. There have been numerous minor collisions involving pedestrians, bicycle, goods vehicles, motor-cycle and cars occurring along the south quays and in a number of places across the study area. These collisions indicate there are safety issues along the south quays. The latest 2014 results report two minor collisions involving pedestrians. This suggests that the modifications introduced over recent years, including traffic calming measures along the south quays have been effective in addressing some these road traffic and safety issues.

The introduction of the proposed development is expected to improve safety and connectivity and improve crossing locations for road users, particularly pedestrians and cyclists.

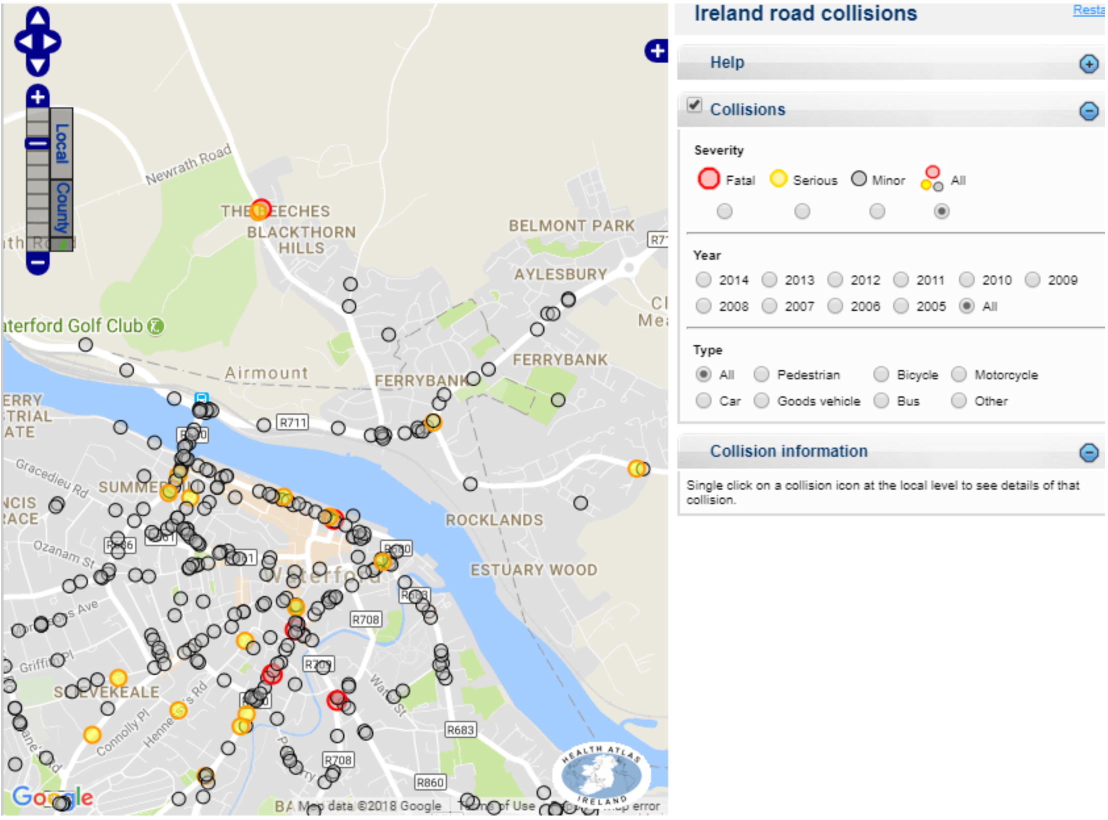

Plate 6.5 Study Area Road Collisions Source: Road Safety Authority

6.3.4.3 Major Accident / Seveso Sites

Human health and the environment are at risk of serious injury due to major industrial accidents which involve dangerous substances. All planning applications within 700m of Seveso sites require referral to the Health & Safety Authority (HSA) for technical advice in order to reduce the risk and limit the consequences of major industrial accidents. The Trans-Stock Warehousing and Cold Storage Limited is designated as an Upper Tier establishment under the Major Accident Seveso III (Directive 2012/18/EU). The site is located approximately 1km from the proposed development in Christendom, Ferrybank.

6.3.4.4 Noise Environment

A baseline environmental noise survey was conducted in the vicinity of the proposed development in order to quantify the existing noise environment in the vicinity of the noise-sensitive locations that may be affected by the proposed development. The Noise and Vibration Chapter 12 details the results of this assessment. The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works, piling activities, breaking operations and lorry movements on uneven road surfaces. The results of the noise survey from Chapter 12 indicate that the baseline noise levels at all locations assessed are dominated by existing traffic flows along the roads within Waterford City.

The results of the assessment indicate that daytime construction thresholds are likely to be exceeded at three locations (R2, R3 and R4). The predicted exceedances are due to noise emissions from concrete breaking and piling activities. Note that whilst the entire programme of works is expected to last 18 – 24 months individual activities such as breaking and piling will likely last for a smaller percentage of the entire programme (approximately 2-3 months) and as such these exceedances will not be occurring continuously throughout the construction phase. Piling is expected to take place at a range of distances from the sensitive receptors with the noisiest part of the piling process only occurring for a relatively short period in comparison with the entire programme.

The Vibration assessment found that the works will not emit vibrations that may cause building damage.

6.3.4.5 Air Quality Environment

Air quality in Ireland and in the area of the proposed development is considered to be good. Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2016" (EPA 2017), details the range and scope of monitoring undertaken throughout Ireland. Long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.) Chapter 13 details the results from this monitoring.

6.3.4.6 Radon

Radon is a naturally occurring radioactive gas that originates from the decay of uranium in rocks and soils. It is colourless, odourless and tasteless and can only be measured using special equipment. The proposed development is located in a high radon area. 'High Radon Area' is one in which more than 10% of homes are predicted to have radon levels in excess of the reference level of 200 Bq/m^3. Radon rises up through the ground to disperse in the air and only becomes a health hazard when it is trapped in buildings.

6.4 Predicted Impacts on Population and Human Health

In accordance with the EPA Guidelines and the above methodology, the following sections provide an overview of the predicted impacts on:

- Land use and social considerations, including effects on general amenity, journey characteristics, journey amenity and severance.
- Economic activity including tourism e.g. employment and population including associated land use.
- Human health, considered with reference to and interactions with other environmental receptors contained in corresponding chapters such as air, noise, traffic, as appropriate.

Likely or predicted significant impacts are split based on construction and operational phases under the headings above. Table 6.16 provides a summary of the predicted significant impacts and mitigation required and any likely residual impacts.

6.4.1 Construction Phase

6.4.1.1 Land Use and Social Considerations

<u>Land use</u>

Land use change from the one existing gangway to be replaced by two new gangways to jetty. Likely *imperceptible negative temporary* impact to mariners/ berth holders in this area during the construction phase. Clock Tower Car park is likely to be the location of a temporary construction compound which will reduce the number of spaces available to road users during the 18 to 24 month construction phase. General land use changes from marina and city centre carpark to construction sites/ compound is likely to have a *moderate*, *negative impact* on landuse characteristics of the area through the construction period.

<u>Journey Characteristics, journey amenity and severance</u>

Construction traffic will include an increase in vehicles transporting bridge elements, construction vehicles including cranes, and other general construction traffic. Construction activities may impact access and journey times during specific periods as part of construction works and installation of the bridge sections for both roads based and navigational channel users.

Chapter 5 Traffic Chapter determined that the closure of the Clock Tower Car Park car park will have a *moderate negative short-term impact* on the traffic movements on the surrounding road network, particularly the R680. Furthermore, any traffic travelling to/from the site will use the R680. Cofferdams and barges will be required in the river channel during the construction period and is likely to change journey characteristics and amenity during the construction period, noise emissions generated during the construction phase may cause nuisance to marina users. Access will be maintained on the navigational channel throughout construction phase. All boat users including search and rescue organisations vessels will continue to have access as required, therefore *no significant* impact on journey times are likely.

Moderate negative short-term impacts on local traffic conditions is likely to impact on journey characteristics and journey amenity along the south quays, particularly close to construction compound on Meagher's Quay located adjacent to the R680.

Pedestrians will experience *imperceptible, negative, short-term* severance along the south quays in the area of the construction site and compound. Access will be maintained to properties throughout the construction phase therefore no other severance is predicted.

<u>Community Facilities</u>

There is potential for community uses such as school traffic using the R680 to be negatively impacted in the vicinity of the construction site however, these impacts are not likely to be significant or change the use of community facilities. A TMP and EOP will be implemented at the design stage to minimise any likely significant impacts.

The construction phase will see the removal of the existing public toilet, public seating, bicycle parking stands and tourist information signage along the south quays resulting in a *slight negative* short-term impact. Alternative suitable locations for this infrastructure will be agreed with WCCC and stakeholders prior to the construction stage within the South Plaza.

6.4.1.2 Economic Activity

General amenity and journey characteristics may be impacted during construction activities and from the construction compound on the south quays resulting in short-term noise, air, visual and traffic disruption. These impacts / disruptions may impact sensitive sites such as hotels and other commercial properties along the south quays and areas close to construction compounds likely to have a *slight negative short-term* impact on economic operators.

The construction compound will result in approximately 200 car parking spaces from the Clock Tower Car park along the South quays which may result in loss of associated revenue. The site is currently being leased from Waterford City and County Council. There are a number of car parks located in the vicinity and a carparking survey completed to investigate the impact (reported Traffic Chapter 5) found that additional carparking has been provided recently in the city and ensures sufficient carparking remains available to service the City.

A TMP will be developed by the contractor at construction stage in order to manage traffic movements to include signage to other carparking areas so as not to impact on commercial activities in the area further addressed in Chapter 5 of this EIAR.

The construction stage will result in direct employment of approximately 20-25 construction workers. Additional indirect employment and economic activity is likely due to provision of goods and services during construction stages.

Cafes, accommodation (i.e. hotels, B&Bs along the south quays and in the city centre area) and other businesses are vulnerable to loss of passing trade however it is considered that these impacts are not likely to be significant and are short-term impacts. The development of the project is expected to increase the overall economic development of the city as a whole and therefore provide long term economic benefits to the local economy, particularly those close to the new infrastructure and the region.

<u>Marine based economic impacts</u>

The River Suir will remain navigable to all marine based traffic through the construction stage. However, it is likely that there will be *slight negative momentary impacts* to marine based operators during the construction stage primarily as a result of construction barges and transportation of materials on the River Suir. The contractor will be required to communicate the Construction stage TMP to the Harbour Master and the Port of Waterford Company to minimise disruption to economic and social activities.

<u>Marine Tourism Impacts</u>

Due to construction activities there may be *slight negative short-term* impacts which may affect the attractiveness and amenity value and may impact on tourist numbers visiting both the South quays at this location and boats berthing from overseas at Waterford City Marina.

6.4.1.3 Human Health

As already stated, environmental health standards are set to protect the vulnerable and not the robust, who are generally more resilient to changes in their environment. In accordance with the methodology outlined in Section 6.2.7, a summary of likely significant human health impacts/ hazards relating to the proposed development have been identified to include:

- Impacts of collisions/risks of accidents;
- Impacts of Emissions to Air;
- Impacts of Noise Emissions;
- Impact of Emissions to Hydrology and Hydrogeology;
- Psychosocial hazards; and
- Effects on physical activity.

Chemical and biological hazards will remain a possibility in certain limited circumstances due during the construction and operation phases from potential traffic, spillages or accidents. These will be managed at detailed design and in accordance with best practice construction methods relating to good housekeeping and implementation of environmental, health and safety standards throughout the lifetime of the project as required by EU Directives, statutory legal requirements and national construction and employment law as appropriate and for this reason are not considered further as part of this environmental assessment.

Prior to any demolition, excavation or construction, a Construction Environmental Management Plan (CEMP) will be produced by the successful contractor. The CEMP will set out the Contractor's overall management and administration of the construction project. The CEMP will be prepared by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the outline CEMP, Environmental Operating Plan (EOP) and the Construction and Demolition Waste Management Plan (CDWMP).

6.4.1.4 Impacts of Collisions/ Risk of accidents

According to collisions statistics the South quays have been the location of a number of fatal and non-fatal collisions. Construction activities are likely to increase risk of collisions due to an increase in the number of movements of HGVs entering and exiting from the construction compound and haulage routes located in a heavily trafficked urban environment. It is also likely to increase potentials risks to vulnerable (young, old, disabled) populations identified as being present in the receiving environment.

Construction workers will be exposed to a risk of potential accidents occurring working at heights, and at or near water. The CEMP and EOP will be required to address these risks and detail measures to address health and safety risks as appropriate. Overall *not significant negative short-term* impact during the construction stage is predicted.

6.4.1.5 Impacts of Emissions to Air

The primary sources of air impacts that may affect air quality from the proposed development occur in the construction phase of the project relating to dust generation and emissions from plant and vehicles. This can cause local impacts through air quality and dust nuisance at the nearest sensitive receptors. The assessment in Chapter 13 relating to the sensitivity of the area to human health impact is low according to IAQM guidance (IAQM 2014). Therefore, there will be a *not significant, short-term- temporary impact* on human health.

6.4.1.6 Impact of Noise and Vibration Emissions

The results of the noise survey completed as part of this EIAR detailed in Chapter 12 indicate that the baseline noise levels at all locations assessed are dominated by existing traffic flows along the roads within Waterford City. The risk hazards include a variety of items of plant which will be in use for the purposes of site clearance and construction. The results of the assessment in Chapter 12 of this EIAR indicate that daytime construction thresholds are likely to be exceeded during the construction stage in two locations result in short-term very significant impacts on human health for those receptors. It should be noted that the closest sensitive receptor (R3 Commercial property in Plate 12.2) to the piling works is estimated to be at 50m distance. Noise levels are predicted as reaching as high as 81 $L_{Aeq,12hr}$ associated with excavator with breaker. Mitigation measures are proposed to address these impacts which will include localised temporary barriers which may give rise to reduction of 10dB in noise levels which would bring noise levels into line with the defined thresholds for these activities. The assessment found that after the application of these measures these are classified as being *negative, moderate, short-term* impacts. The Contractor undertaking the construction of the works will be required to take specific noise abatement measures and comply with the mitigation measures included in the Noise and Vibration Chapter 12. Any human health effects demonstrated are more likely at higher noise levels and over sustainable periods of time. The significant noise predicted during the construction stage will be short-term in nature, controlled by a range of mitigation measures and therefore significant negative human health effects are not predicted during the construction stage.

Chapter 12 also assessed the vibratory piling works that will be carried out at the south abutment and at the sheet piling for the temporary cofferdams. The closest receptor to the vibratory piling works is estimated to be approximately 50m distance (commercial property on the south quays) and the Clock Tower is estimated to be approximately 30m from the vibratory piling works. These works will take place in a controlled manner and during day time hours. In case a piling option is selected to prevent the settlements under the south plaza, Continuous Flight Auger (CFA) piles at suitable depth and spacing will be specified in order to avoid the excessive noise and vibrations in close proximity to the surrounding sensitive receptors. The advantage of selecting CFA piles is they are virtually vibration free and suitable for the soils and the type of development proposed on the South quays. The vibration assessment found that the works will not emit vibrations that may cause building damage and therefore are not likely to impact on human health.

6.4.1.7 Impact of Emissions to Hydrology and Hydrogeology

Water quality

The River Suir is not a source of drinking water and therefore is not considered to be a significant human health issue in this context. However, mitigation measures are proposed as part of this EIAR in Chapter 10 in order to mitigate any likely contaminants entering the water table and River Suir which may potentially affect human health during the construction and operational phases. Therefore, no further mitigation is deemed to be required as part of this assessment.

Flood Risk

Chapter 10 (Hydrology) found that the volumes displaced by the proposed bridge piers, abutments and cofferdams during construction phase is extremely small relative to the volumes of the receiving waterbodies and will result in a slight to imperceptible impact.

The existing flood defences on the south quays will have to be removed to allow for the integration of the bridge abutment. There is potential for inundation at this location during the construction period without the implementation of mitigation measures. Two sections of flood wall east and west of the proposed bridge will be removed to provide access to the new jetties, these will be replaced with flood gates. Temporary flood defences will be provided during construction at this location to maintain the south quays flood defences to a level of 3.7mOD. Therefore, the impact is deemed to be a *slight-imperceptible, neutral*, *short-term* on human health.

Hydrogeology

All foundation piles will be filled with concrete immediately after excavation preventing any contamination of the bedrock aquifer. Chapter 9 of this EIAR found that there is likely to be an *imperceptible* impact on hydrogeology.

6.4.1.8 Impacts of Emissions to Soil

Chapter 8 (Soils and Geology) of this EIAR was consulted regarding potential for contaminated land. The results indicate that there is no known existing contaminated soils and all borehole samples were classified as non-hazardous. During the construction stage, mitigations measures to reduce any adverse impacts to river water quality are described in Chapter 8 (Soils and Geology) and in Chapter 9 (Hydrogeology).

6.4.1.9 Psychosocial Impacts on Human Health

Consideration of likely psychosocial hazards relating to the proposed development include nuisance, anti-social behaviour and suicide. During the construction phase the proposed development has the potential to create nuisance particularly due to emissions from noise, air and dust that can impact on psychological health (described above). The construction activities are limited to specific locations and daytime periods for use of certain plant and machinery in order to reduce impacts to sensitive receptors.

6.4.1.10 Other Physical Effects

The construction stage is not likely to result in changes / impact significantly to physical activity during the construction stage.

6.4.2 Operational Phase

6.4.2.1 Land use and Social Considerations

The proposed development supports long-term land use planning policy and will facilitate the creation of create sustainable land use and travel patterns in the City into the long-term. The bridge and South Plaza will become a transportation route and civic space and local amenity for the city connecting the City (north and south) and is likely to result in long-term positive, social and economic effects for the City. This assessment has found that the proposed development is consistent with land use policy for the area and is likely to ultimately change the intensity of patterns, types of activities and land uses particularly in support of the future development pertaining to the NQ SDZ.

On the south quays, part of the Clock Tower car park will become a new public plaza, i.e. the 'South Plaza' along the south quays. The plaza is expected to support social cohesion, economic development and integration of communities across the City. The sustainable transport bridge itself will improve journey characteristics, general amenity, and reduce severance between communities travelling to/ from the city centre to the northern environs. The design of the seating areas and provision of wind shielding along the bridge will ensure that the journey characteristics and amenity are maximised for enjoyment and as a new amenity as well as a transportation route.

The Sustainable Transport Bridge supports many of the SDGs such as 'sustainable cities and communities', 'climate action' and 'affordable and clean energy' as a result of providing physical infrastructure that supports walking and cycling and an electric shuttle bus that supports sustainable land use patterns and encourages behavioural change and in turn supports a cleaner environment (reduced air and noise emissions and healthier society.

The proposed development is likely to have a *moderate, positive, long-term* impact on the land use, journey characteristics and amenity and provide relief from severance between north and south of the City. These are discussed in more detail in the following sections.

<u>Land use</u>

On the South quays the proposed development will lead to a permanent change in land use from an existing car park to a sustainable transport route and the South Plaza. The South Plaza will result in a loss of approximately 150 carparking spaces. This land use change will create a *significant positive long-term* impact on land use and general amenity in the City for the population. The proposed development will change access arrangements to the existing jetty from one gangway to two gangways and will create two new accesses, 70.4m of length of berthing facilities will be permanently replaced by the sustainable transport bridge.

Journey Characteristics, Amenity and Severance

The construction of the proposed new sustainable transport bridge increases the potential walking catchment from the City Centre to the areas north of the River Suir by approximately 4,000 people, and the cycling catchment by approximately 7,400 people. Should there be a mode shift for these areas, equivalent to the areas in Waterford City south of the River Suir, this would equate to nearly 1,000 fewer car trips at peak times.

It is anticipated that with the provision of the proposed development, the overall travel distances for pedestrians and cyclists between the City Centre and residential areas will be reduced by up to 1km or equivalent to 12-14 minutes' walk or 5 minutes cycle - the improvement in walk and cycle accessibility is demonstrated in the isochrone maps in Plates 5.11-5.14 of Chapter 05 of this EIAR.

The opening section of the Sustainable Transport Bridge central span provides a 25m wide navigational channel in its open position (unlimited vertical clearance). Vessels going upstream of the sustainable transport bridge will be limited by the width of the navigational channel which is similar to that provided at Rice Bridge. It is envisaged that the bridge can be opened or closed in no more than a specified value which shall be agreed with Waterford City and County Council and the Port of Waterford, (typically of the order of 120 – 150 seconds). Therefore, momentary interruption to journey characteristics is likely for traffic on the bridge and under when the bridge is required to open/lift.

The census 2016 figures report that 6,000 people in Waterford City and suburbs currently walk to work, school or college. The proposed development will enhance journey characteristics and amenity for some of this population. 520 people are reported as cycling to work, school or college in 2016. The proposed development is likely to increase this number significantly over the long-term along with wider infrastructure improvements to the cycle network as well as support for the bike sharing scheme planned for the City. The projected 1,000 fewer car trips at peak time will result in significant relief from severance due to mode shift. However, it is projected that future development of the NQ SDZ is likely to balance out leading to a neutral long-term impact overall.

Waterford's population is very young and also has a significant cohort over the age of 65. The provision of the shuttle bus will facilitate access to vulnerable populations as well as connections to existing and future public transport infrastructure across the City. The provision of the shuttle bus service ensures that vulnerable road users (including the elderly, very young or sick or those with disabilities) can easily access the SDZ and the city centre area. It will also benefit the general population, particularly during inclement weather. The shared space nature of the proposed development also facilitates improved journey characteristics and journey amenity, including safer pedestrian and cyclist crossing and result in relief from existing severance caused by the heavily trafficked Rice Bridge and south quays traffic accessing the city centre.

A parapet / windshielding of variable depth will satisfy the minimum requirement of 1.4m high protection parapet throughout. The comfort and safety of bridge users (pedestrians, cyclists and electric bus users) have been carefully considered and the proposed combination of structural solid upstand and parapet / windshielding to a minimum height of 1.4m will be supplemented by further wind studies during the detailed design development to determine the optimum height and porosity of the parapets / wind shielding. This will be confirmed by both computational fluid dynamics and wind tunnel testing to determine user comfort and the effect on the electric bus (which would be considered to be a wind susceptible vehicle [WSV]).

The South Plaza and road arrangements at the Clock Tower will include associated upgrades to the road and public realm with a consequent *moderate positive long-term* impact on journey characteristics and amenity. User hierarchy along the south quays at the bridge connection ensures that crossing the R680 will be prioritised for pedestrians and cyclists and will be managed by traffic calming measures as detailed Volume 3 of this EIAR. Measures include a turning circle area in front of the Clock Tower and signalised junction, traffic calming measures and public realm improvements will also be designed in order to ensure journey characteristics and amenity are managed so as not to cause anxiety/ conflict between drivers, pedestrian and cyclists.

Vehicular traffic is not permitted on the proposed bridge apart from an electric bus and emergency services, therefore the proposed development is not likely to result in a change to vehicular traffic dramatically from the current conditions. The proposed bridge is likely to change pedestrian and cyclist patterns over the long term as it will become a safer and more attractive alternative to the heavily trafficked Rice Bridge and south quays and will, over the long-term, support population growth and modal shift from car-based travel to walking and cycling particularly for shorter trips currently occurring by car.

The proposed development has been designed to support a range of bus movements in order to support a future transportation proposal likely to be developed as the NQ SDZ area is developed. There will be significant positive long-term cumulative impacts associated with the proposed development, these are discussed in Chapter 17 of this EIAR.

The development will provide relief from severance for pedestrians and cyclists and public transport users and have a positive long-term impact in terms of reducing potential social severance between communities located north and the south of the River Suir. Pedestrians and cyclist journeys will only be momentarily interrupted by the shuttle bus movements (likely to be every 20 minutes during day time hours) and turning movements in front of the Clock Tower. Otherwise the area is freely accessible with pedestrians and cyclists maintaining priority. Existing roads, footpaths and cycleways will remain open and will connect to the proposed development improving connectivity across the City. New severance along the navigation channel will occur due to the construction of the opening bridge structure however the River Suir will remain navigable during both construction and operational phases and therefore this severance is not deemed to be significant.

The existing floating jetty will be severed due to the construction of the bridge however alternative accesses (two new gangways) will be constructed and are included as part of the design of the bridge, therefore this impact is a *not significant, negative, permanent* impact.

<u>Community Facilities</u>

Unobstructed access of the River Suir upstream and downstream is required for both of search and rescue vessels (Waterford City River Suir Rescue and WMSAR) in order to patrol to River. The patrol boats require a 2.5m vertical clearance to the bridge soffit at all tide levels. The navigation channel at the Sustainable Transport Bridge provides this clearance over its full width (assuming a high tide of 2.4mOD Malin). Stakeholders will be communicated with directly, as required in the Stakeholder Communication and Management plan recommended.

The proposed development provides an opportunity for improved social cohesion and access to community facilities within the city and suburbs. First and foremost, the proposed development results in a significant improvement in the physical community infrastructure and transportation function of the City. It will facilitate access to existing transport 'community' infrastructure such as the bus and train station, education, religious, recreational and employment opportunities. It will also connect with planned future projects detailed as part of the NQ SDZ Planning Scheme, thereby continuing to support the community infrastructure of the City. Public realm improvements including appropriate locations for seating and places for people to interact and enjoy the South plaza will be designed into the south quays public plaza are included in the design of the South Plaza.

It is likely that pedestrian and bicycle access to existing and future social, community and education facilities will improve over the long term with cumulative benefits for pedestrian and cyclist access as a result of the proposed development particularly to the nearby education and recreation facilities e.g. Abbey Community College and Schools in the city centre being accessed to/ from Ferrybank residential areas. The projected mode shift from car to walking and cycling and public transport in the vicinity, together with safer road crossings, provides an opportunity for more walking and cycling by the population including the significant young and student population of the City and suburbs. *Positive, long-term* impacts are predicted.

6.4.2.2 Economic Impact

The proposed development is seen as a key piece of critical infrastructure that will support the future development of projected retail development and economic returns which is likely to have both direct and indirect benefits to Waterford City and region.

The removal of the section (70.4m) of existing floating jetty will result in a loss in berthing facilities available in Waterford City Marina and loss in potential revenue from this section of the Marina, however there is current capacity to absorb existing berth holders in this area downstream and these impacts are predicted to result in a *moderate, negative, permanent impact* to Waterford Marina.

The removal of approximately 150 carparking spaces is likely to have a *slight*, *negative permanent* impact to the Clock Tower Car park which is currently being leased from Waterford City and County Council. There may be a loss of economic activity associated with reduced passing trade associated with reduction in the number of car parking spaces along the south quays. However, this is not considered to be a significant impact and on the reverse the proposed development is likely to increase footfall over the long-term.

River Suir Cruises operate from existing floating jetty. They will be relocated downstream of the sustainable transport bridge and is not expected to have an economic impact.

The proposed development does not impede the passage of Tall Ships and therefore is not likely to impact on any future events.

The operation of the electric shuttle bus will provide employment of approximately 2 drivers resulting in an *imperceptible positive* impact on the local economy.

The proposed development includes the route of the Greenway (and will connect with existing and future Greenways planned in the City. Greenways are a key growth area in terms of the tourism sector and provide an additional economic stimulus for regions.

The development will also shorten pedestrian and cyclists journey length by approximately 1km and improve connectivity between the north and south of the city including improved access to the existing public transport infrastructure (bus station) and proposed transportation hub and connectivity between the existing Dungarvan to Waterford Greenway and proposed Waterford to New Ross Greenway. The transfer of pedestrian and cyclist traffic to the proposed development is likely to increase the footfall and number of trips resulting in potential for increased economic activity in the area. The overall impact is likely to be *moderate*, *positive, long-term* impacts.

The proposed development is likely to also provide an economic and tourism stimulus to locations across the city centre and region. The improved connectivity, journey time and journey amenity for pedestrians and cyclists is expected to increase footfall travelling between the north and south of the city and has the potential to increase social and economic activity in the area around the proposed development and across the wider City.

<u>Marine based economic impact</u>

Consultation with Waterford City and County Council operators of Waterford Marina have indicated that there is current capacity within the existing marina during off peak times to accommodate the loss of the areas (70.4m) required to construct the bridge translating into the loss of approximately 20 boats (the number will vary depending on the size of boats berthing at any given time). It is expected that the loss of berths will result in a moderate*, negative, permanent impact*.

The length of time that the bridge will take to open will typically be approximately 150-200 seconds, it is possible that journey times along the River Suir navigational channel will increase for vessels that will require the bridge to lift. Procedures for bridge lift will be developed at detailed design in partnership with appropriate stakeholders in order to ensure these are sequenced appropriately and the proposed development along with the opening of Rice Bridge do not impact significantly on operators using the channel. The navigational channel will remain navigable after construction, and no other economic impacts are predicted.

6.4.2.3 Human Health

Journeys by foot and bike are likely to become safer and more pleasant, representing a *moderate positive human* health impact. Census figures have shown that a significant number of people walk in Waterford City. This is expected to increase with the proposed development and improved amenity areas. Census figures also show few at present currently cycle. The proposed development is expected to support an increase in cycling journeys along with other (hard and soft) infrastructure improvements e.g. implementation of Smarter Travel policy, Greenways, integration with green routes existing and planned throughout the city, that will help improve safety and legibility for cyclists. The proposed development is likely to increasing walking and cycling thereby resulting in health and well-being benefits associated with active modes of travel and represents a *moderate positive* long-term impact.

There will also be greater opportunities to promote both walking and cycling due to the proposed development and as a result of future developments such as those outlined in the NQ SDZ Planning Scheme i.e. the sustainable transport hub which is required to facilitate a comfortable interchange across all modes of travel.

6.4.2.4 Impacts of Collisions/ Risk of accidents

The proposed development will connect with the south quays, the R680 at Meagher's Quay and Barronstrand Street. *Slight, positive, long-term* impacts are likely as the proposed development prioritises pedestrian and cyclist traffic. It is likely to improve crossing locations and reduce risk of collisions/ accidents due to improvements in public realm, traffic calming and prioritisation of pedestrian and cyclist through shared spaces surface. The risk of impact and collisions due to river vessels has been considered and the vessel collision protection structures have been developed based on the AASHTO Standard Method II – Probabilistic Based Methods.

6.4.2.5 Impacts of Emissions to Air Quality and Climate

No road vehicles apart from an electric bus are permitted to use the proposed development therefore based on the assessment undertaken in Chapter 13 (Air Quality and Climate) road traffic is not expected to be a dominant source of greenhouse gas emissions (GHG) resulting from the operational phase of the proposed development. Therefore, no *significant* source of emissions likely to impact on human health.

In terms of climate, the nature of the development is such that there is no predicted impact on traffic, beneficial or adverse. It is envisaged that there will be no change in (annual average daily traffic) AADT due to the proposed development. Therefore, the climate assessment found that no road links could be classed as 'affected' by the proposed development and do not require inclusion in the regional climate assessment. Therefore, based on Chapter 12 of this EIAR emissions resulting from the proposed development are likely to have an *imperceptible* impact on air quality and climate from a on human health perspective.

6.4.2.6 Impacts of Noise Emissions

During the operational phase it is expected that noise emissions from the proposed development will be not be perceptible above the existing noise environment resulting in a *neutral, imperceptible, long-term* impact. Therefore, the impacts on human health are assessed as imperceptible.

6.4.2.7 Impact of Emissions to Hydrology and Hydrogeology Operational

Water quality

It is not anticipated that any chemicals or hydrocarbons will be transported across this bridge. Therefore, it is not anticipated that the risk of spillage will occur, therefore the impacts on human health are assessed as *imperceptible.*

Flood Risk

A section of the exiting flood defences on the south quays will be altered at the southern abutment and two smaller sections replaced with flood gates to provide access to the new jetties. The bridge deck merges with the south quays landing at a level of 4.2mOD. This is 0.5m higher than the existing flood defence level on the south quays, thus maintaining the existing standard of protection. The potential impact is slight. The recommended mitigation measures detailed in Chapter 10 of this EIAR will mitigate against potential risk of flooding at the north and south quays. No public health issues remain as a result of the proposed development.

6.4.2.8 Psychosocial Impacts on Human Health

Consideration of the negative psychosocial hazards relating to the proposed development include potential for nuisance, anti-social behaviour and in the worst case could potentially create a new location for suicide events to occur.

The proposed development is located in a city centre environment close to a heavily trafficked urban environment, active during both the day and night. As a result of the exposed nature and constant overlooking it is unlikely that the proposed development would promote anti-social behaviour.

Suicide deaths have the potential to create a profound human health impact to those individuals and their network of friends and family. Some studies have shown that the inclusion of measures such as anti-climbing, bridge-barriers/barriers to falling or nets have the potential to reduce "*93% reduction in suicide deaths at the site in which they are implemented.*" (Toronto Public Health, 2018) but do not avoid suicide deaths entirely. Therefore, it is not possible to completely design a bridge to avoid/ prevent against suicide death. The provision of combined structure / parapets and wind-shielding on the proposed development will make the bridge more difficult to climb than for example the existing Rice Bridge and hence act, somewhat, as a deterrent to potential suicide deaths occurring at this location. However, the assessment has found that due to the construction of a new bridge structure it represents a new location for suicide deaths to occur and is therefore deemed to be a *profound negative* impact.

Overall, there is likely to be positive psychosocial impacts on the community due to improved connectivity, particularly communities north and south of the river and particularly for pedestrians, cyclists including tourists and as a result of regeneration associated with land use changes and increased economic prosperity. The proposed development is likely to have *positive, long-term* impact due to providing alternatives to the private car use and likely indirect secondary psychosocial effects as a result of promoting physical activity, facilitating improved social connections, amenity and meeting place for Waterford's residents and visitors.

No acquisitions of private property is required as a result of the proposed development therefore no psychosocial impacts are likely in this regard.

6.4.2.9 Other Physical Effects

Effects on physical activity

The benefits of physical activity are widely reported and include benefits such as improved fitness, mood and can improve the potential for social interaction and social cohesion. From a human health perspective this can translate into improved cardiovascular 'fitness', help reduce chronic disease and even premature death.

Land use planning and transport patterns can influence physical activity and/ or inactivity of populations which in turn can influence lifestyle factors and human health outcomes. Transport patterns that promote walking cycling and sustainable modes of travel can reduce sedentary lifestyle, increasing activity and improve health outcomes. Obesity in Ireland is a significant health issue and can be linked to travel mode as well as lifestyle factors. The operational phase of the proposed development is likely to impact on changes to physical activity by providing improved walking and cycling infrastructure, options to using the private car and supporting the use of wider network of public transport infrastructure in Waterford over the long-term.

Overall, this assessment has found that the likely significant human health effects are positive as a result of the proposed development. The primary hazards were found to be physical hazards primarily relating to emissions to the noise environment during the construction phase. During the operation phase, the risk of suicide from the new bridge structure has the potential to result in a *profound*, *negative* human health impact. Overall this assessment has found that the proposed development will result in *significant, positive, long-term* human health effects due to the provision of sustainable transport infrastructure that supports sustainable land use patterns, promotes walking, cycling and public transport as a mode of travel. This in turn has the potential to have positive lifestyle, health and environmental benefits (reduction in noise, air and GHG emissions) over the operational phase. The bridge structure will also have the potential to positively impact on the wider economy over time which could in turn result in reducing social inequality and the high deprivation rates in the City which are found also to influence health outcomes of populations.

6.5 Mitigation Measures

The design process, site visits and public consultation has allowed for the inclusion of a number of mitigation measures for Population and Human Health as part of the design of the sustainable transport bridge and the South Plaza.

6.5.1 Construction Stage Mitigation Measures:

- Develop and implement all mitigation measures detailed in Chapter 4 (Description of the Proposed Development) this is to include development of Construction Environmental Management Plan (CEMP) and associated Traffic Management Plan (TMP) to address all modes of transport including the navigational channel and will be required to be agreed with WCCC prior to construction stage.
    - The TMP will be required to maximise the safety of the workforce and the public and minimise traffic delays, disruption and maintain access to properties.
    - The TMP will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points.
    - The contractor shall provide an appropriate information campaign for the duration of the construction works.
    - The TMP should minimise disruption to economic, marine users and residential amenities to be agreed by WCCC prior to construction and ensure access is maintained along the R680 for vehicles, pedestrians, cyclists and economic operators at all times and ensure marine navigation is maintained.
- Include appropriate measures relating to working at heights and near water as part of EOP. Install and maintain ringbuoys as part of construction design stage in consultation with the Irish Water Safety and Waterford Search and Rescue Organisations.
- The contractor will be required to develop and implement Stakeholder Management and Communication Plan and will be required to be agreed with WCCC prior to construction stage.
    - All stakeholders will be required to be agreed with WCCC prior to construction commencing.
    - Details of the general construction process/phasing will be communicated to the relevant stakeholders prior to implementation to ensure local residents and businesses are fully informed on the nature and duration of construction works.
- Detailed design to identify a suitable location to relocate the pay station/ office in consultation with QPark operator to be agreed by Waterford City and County Council.
- Noise and Vibration mitigation will be provided for during construction of the development. Measures to mitigate noise and vibration impacts on sensitive

receptors are detailed within Chapter 12 Noise and Vibration. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities including the application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures.

- In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan (refer to Appendix 13.1 of this EIAR). Provided the dust minimisation measures outlined in the plan are adhered to, the air quality impacts during the construction phase will be not be significant. No further mitigation measures are required.

All construction works will be short-term in nature and will be carried out in line with best practice thereby minimising the likely significant impacts to the community and human health impacts. The contractor will work within stringent construction limits and guidelines to protect surrounding populations and amenities.

With the application of the mitigation measures identified in this section along with those specific mitigation measures related to Population and Human Health described in Chapter 5 Traffic and Transport, Chapter 11 Landscape and Visual, Chapter 12 Noise and Vibration and Chapter 13 Air Quality and Climate of this EIAR. Chapter 16 Material Assets no likely significant impacts are predicted during construction stage. All mitigation measures are summarised in Chapter 18 of this EIAR.

6.5.2 Operational Stage Mitigation Measures

This assessment has found that the proposed development will result in very significant long-term positive impact on the land use and social, community and economy of Waterford City and the South East region. The creation of an attractive public South Plaza making the city centre more attractive, safer and accessible to shoppers and visitors resulting in benefits to the local economy.

Mitigation measures required to address likely significant impacts include:

- Installation of 24/7 CCTV cameras across the bridge to be agreed by Waterford City and County Council prior to construction.
- Design and maintain suitable landscaping and public realm infrastructure to complement other environmental mitigation, e.g. lighting, seating, landscaping, pleasant surroundings to discourage anti-social behaviour, graffiti, etc.
- Implement the recommended mitigation measures detailed in Chapter 10 (Hydrology) to address potential risk of flooding.
- Appropriate information signage will be put in place on local roads to guide residents and visitors to the use of the sustainable transport bridge, greenway and connections to other sustainable transport infrastructure.
- Replacement of public amenities in suitable locations, as required (i.e. toilets, seating, bicycle stand and tourist information signage) on south quays as part of detailed design stage within the South Plaza or along the south quays and will be required to be agreed with WCCC prior to construction stage.
- Install and maintain ringbuoys as part of detailed design stage in consultation with the Irish Water Safety and search and rescue organisations in Waterford.

With the application of the mitigation measures identified in this section along with those specific mitigation measures related to Population and Human Health described in Chapter 5 Traffic and Transport, Chapter 11 Landscape and Visual, Chapter 12 Noise and Vibration and Chapter 13 Air Quality and Climate of this EIAR. Chapter 16

Material Assets no likely significant impacts are predicted during operational stage. All mitigation measures are summarised in Chapter 18 of this EIAR.

6.6 Residual Impacts

During the construction phase residual impacts include disruption to the traffic environment which is likely to have *slight - moderate, negative* short-term residual impacts to the traffic, air and land uses including economic and tourism facilities in the immediate vicinity of the construction activities including those in the marine environment. The assessment found that after mitigation there will there will still be *moderate, negative, short-term* noise impacts during the construction phase.

During the Operation phase, the proposed development will result in a *moderate to significant, positive, long-term* impacts due to development of sustainable transport infrastructure and benefits to the population, economy and potential human health benefits. The development will improve connectivity, journey characteristics and reduce journey time for pedestrians and cyclists travelling north and south of the City. It will also have the potential to create an increase in local economic activity in the area due to increased footfall. Details of all other significant residual effects are set down in Table 6.16 of this Chapter.

6.7 Conclusions

The EIAR has considered and assessed the likely significant effects with regard to population and human health associated with both the construction and operational phases of the proposed River Suir Sustainable Transport Bridge.

The assessment has found that the construction phase is likely to interrupt journey characteristics and general amenity deemed to result in moderate, negative short-term impacts. The loss of parking on the south quays, construction activities and site compound may negatively impact on the business environment and residential amenity land uses in this area. However, the construction stage is also likely to result in positive impacts on the local economy due to employment and local expenditure by construction workers, purchases of local materials and services. Emissions from the construction activities such as noise, air and risk of accidents were found to be potential short-term, negative impacts. It was found that noise emissions from construction activities, plant and machinery on site is likely to have a significant noise impact within the immediate area during distinct construction phases (i.e. piling and excavation activities) of the development. However, with the application of various best practice working methods to control noise impacts reduces these impacts to moderate, negative short-term. All construction stage impacts will be short-term in nature and reduced and managed by CEMP and associated TMP, EOP and CWDP and the range of mitigation measures of this EIAR.

Overall, the operation of the proposed development is expected to have positive, long-term impacts on the population and human health of the City and South East region. The assessment found that the proposed development is likely to result in positive long-term change to land use intensity and the nature of activities in Waterford City and for the population's journey characteristics, journey amenity and general amenity due to the improvement in transportation infrastructure and improved connectivity to existing and future developments in the City (i.e. Greenways, future transport hub, regeneration of the NQ SDZ). Journeys by foot and bike are likely to become safer and more pleasant. The bridge will provide relief from existing severance currently experienced north and south of the river.

Improvements are also likely to the population and visitors with regards to general amenity, safety and quality of life issues associated with the sustainable transport bridge and also improved connectivity between cultural, commercial and residential quarters across the City. The proposed development will result in direct employment of a minimum of 2 bus drivers, resulting in direct positive impacts to the local economy. There will be improvements to the public realm due to a new South Plaza and look out areas as part of the bridge structure which are likely to result in positive indirect impacts for the local economy. It was found that the risk of suicide death due to the construction of a new bridge structure in the City has the potential to have a profound human health impact. The provision of combined structure / parapets and wind-shielding on the proposed development will make the bridge more difficult to climb than for example the existing Rice Bridge and hence act, somewhat, as a deterrent to potential suicide deaths occurring at this location. Overall, impacts are likely to be positive in terms of supporting improvements in the populations health and well-being due to the provision of safe, affordable, sustainable travel modes that conform with existing and future planning policy and support a change in travel behaviour and sustainable development in city centre locations.

Table 6.16 Population and Human Health Predicted Impacts, Mitigation and Residual (Construction and Operational Phases)

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Construction Stage								
Land use change from river to two new gangways to access existing floating jetty.	Existing floating jetty, Meagher's Quay/ River Suir	Mariners including Waterford Marina Berth holders	Land use change from the existing gangway to be replaced by two new gangways to Existing floating jetty. The design includes the Construction of two new gangways and associated entrances from with Flood gates on Meagher's Quay prior to the closure of the existing gangway.	Imperceptible negative	Temporary	Landscape, Visual, Hydrology	Contractor to implement a Construction Environmental Management Plan (CEMP) which will include a Traffic Management Plan (TMP), EOP and Stakeholder Management and Communication Plan to be agreed with WCCC.	Neutral
Land use change	Construction site and compound	Mariners and general public	Land use changes from marina and city centre carpark to construction sites and construction compound.	Moderate negative	Short-term	Landscape, Visual, Hydrology	Contractor to implement a CEMP, TMP, EOP, Construction and Demolition Waste Management Plan (CDWMP). No additional mitigation proposed.	Slight negative
Journey characteristics and journey amenity along the south quays	R680 and Construction Compounds	All road users, the public and residents.	Potential for traffic delays to road users due to slow moving traffic and construction traffic entering construction compounds. Possible road delays when R680 upgrades are nearing completion.	Moderate negative	Temporary – short-term effects	Noise, landscape and visual and air quality.	Contractor to develop a TMP at design stage.	Imperceptible negative

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Loss of community infrastructure	South Quays	Residents and visitors	Loss of public toilet, public seating, bicycle parking stands and tourist information signage along the south quays due to construction activities.	Slight negative	Short-term	Landscape & visual	Alternative suitable locations for this infrastructure will be agreed with WCCC and stakeholders prior to the construction stage within the South Plaza.	Neutral
Economic Activity, Journey Characteristics and Amenity	City centre, south quays, Rice Bridge Ferrybank and residents and businesses along transport routes R448, R711, R680.	Residents, visitors and economic activities including impact on employer and employees.	Construction activities have the potential to impact economic activity due to noise, air and traffic disruption. Visual intrusion is also possible due to use of hoardings against dust.	Slight negative	Short-term	Traffic, noise, landscape & visual, and air quality	Maintain access to economic operators at all times. Conform to TMP, EOP to minimise impacts. Contractor to implement Stakeholder Management and Communication Plan (SMCP).	Imperceptible negative.
Economic Activity:	Not defined. (National, regional and/ or local employment populations).	Labour force	Increased direct and indirect employment opportunities. 20-25 employed during construction phase. Additional indirect employment and economic activity is likely due to provision of goods and services during construction stages.	Slight positive	Short-term	N/A	No mitigation proposed.	Slight positive

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Residential amenity, general amenity and journey characteristics	South quays City Centre area.	Economic activities	Loss of passing trade due to construction activities, traffic disruption, noise, air and visual impacts.	Slight negative	Short-term	Traffic, noise, landscape & visual, and air quality	Maintain access to economic operators at all time. Contractor to implement TMP to minimise impacts. Contractor to implement SMCP.	Slight negative
Journey time on Navigational River	River Suir	Economic Operators	Navigational journey time may be disturbed during limited periods.	Slight negative impact	Momentary effects	None	Minimise disruption Conform to Traffic Management Plan for managing the navigational channel.	Neutral
Economic	Land use change Loss of approx.200 car spaces.	Qpark	Loss of revenue	Slight negative impact	Short-term Permanent	Traffic	Compensation measures. No additional mitigation.	Neutral
Human Health - Risk of Accidents/ Collisions	Disturbance, disruption due to construction activities	Construction workers and Population including vulnerable groups.	South quays and surrounding local and community environments	Not significant negative impact	Momentary/ Short-term	Traffic, Emergencies and Accidents	As per mitigation in Chapter 4 including implementation of TMP, EOP. SMCP.	Imperceptible
Human Health - Air quality	South quays and surrounding environments identified within associated EIAR Chapters	Population including vulnerable groups.	Disturbance, disruption due to construction activities	Not significant	Short-term/ temporary	Traffic, Air Quality and Climate, Landscape and Visual	As per mitigation in Air Quality and Climate Chapter 13. Good housekeeping, maintenance of plant and vehicles etc.	Imperceptible

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Human Health - Noise emissions	South quays and surrounding environments identified within associated EIAR Chapters	Population including vulnerable groups.	Construction activities	Significant negative impact	Short-term	Traffic, landscape and visual.	As per mitigation in Noise and Vibration Chapter 12 and implementation of SMCP.	Moderate negative.
Human Health - Water Quality and Flooding	South quays and North Quays identified within associated EIAR Chapters	Population including vulnerable groups.	Removal of flood defences could affect water quality and impacts due to flooding on people and property during extreme rainfall events.	Slight - Imperceptible	Short-term	Material Assets, Hydrology and Hydrogeology	Mitigation measures identified in Chapter 9 and 10	Neutral
Operational Stage Predicated Impacts								
Land use & Social Considerations, General Amenity, Severance, Economic Activity	Waterford City centre North and South quays	Public. Pedestrians and cyclists.	Construction of new bridge and plaza will improve journey amenity, relief from severance and facilitate river enhancements to existing and proposed river walkways and green routes across Waterford City.	Moderate positive	Long-term effect	Landscape and Visual	No additional mitigation.	Moderate Positive
Journey Characteristics - Journey Time	River Suir	Mariners. Economic operators. Emergency Services Pedestrians & Cyclist on Bridge	Bridge lifting may interruption some journeys resulting in increased journey time (likely to be 150-200 seconds) to be agreed by WCCC.	Slight negative	Momentary effects	Landscape and Visual	No mitigation proposed.	Imperceptible Negative.

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Land use Change and Economic Activity	Impact on existing floating jetty, Meagher's Quay/ River Suir	Waterford Marina and Mariners including mariners and berth holders.	Removal of 70.4m of berthing facility from the existing floating jetty.	Moderate negative	Permanent	Material Assets, Landscape and visual.	Provision of access to reconfigured existing floating jetty provided in design. No additional mitigation proposed.	Slight Negative
Land use change & Social Considerations	Merchants Quay	The public including tourists	Removal of public toilets, cycle stands, some seating areas and tourist information signage due to construction of plaza.	Not significant negative	Permanent	Landscape & visual.	Replacement of public amenities in suitable locations, as required (i.e. toilets, seating, bicycle stand and tourist information signage) on south quays as part of detailed design stage within the South Plaza or along the south quays and will be required to be agreed with WCCC prior to construction stage.	Positive

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Land use and Social Considerations - Journey Characteristics, General Amenity, relief from severance	Waterford City centre North and South quays	Public. Pedestrians and cyclists.	Construction of new bridge and plaza will improve journey amenity, relief from severance and facilitate river enhancements to existing and proposed river walkways and green routes across Waterford City.	Moderate positive	Permanent effect	Landscape and Visual	Design and maintain suitable landscaping and public realm infrastructure to complement other environmental mitigation, e.g. lighting, seating, landscaping, pleasant surroundings to discourage anti-social behaviour, graffiti, etc	Positive
Economic Activity	Existing floating jetty	Waterford Marina	Loss in potential revenue due to reconfiguration of the existing floating jetty.	Moderate Negative	Permanent	Material Assets, Landscape and visual.	No mitigation proposed.	Moderate Negative
Economic & Land use Change	Clock Tower Car Park Meagher's Quay and Merchants Quay.	QPark and car parking users	Loss of approximately 150 car parking spaces to facilitate construction of Plaza.	Slight negative	Permanent	Material Assets, Landscape and visual.	Compensation measures likely. Detailed design to identify a suitable location to relocate the pay station/ office in consultation with QPark operator to be agreed by Waterford City and County Council. No additional mitigation.	Neutral

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Economic Impact, General Amenity	Waterford Quays and City centre area.	Economic operators	Likely increase in footfall.	Moderate positive	Long-term	Landscape and visual, Material Assets	Appropriate information signage will be put in place on local roads to guide residents and visitors to the use of the sustainable transport bridge, greenway and connections to other sustainable transport infrastructure.	Positive
Economic Activity – Employment.	Sustainable Transport Bridge	Labour force	Employment of 2 drivers of the shuttle bus.	Imperceptible positive	Long-term	Materials Assets	No mitigation proposed.	Neutral
Human Health - Journey Amenity, Characteristics	Site and Waterford City	General population	New pedestrian, cycling and public transport infrastructure support this mode of transport and can have positive impacts on health outcomes as well as reduce noise and air (GHG) emissions to the environment.	Moderate positive	Long-term	Traffic, Air Quality and Climate, Noise and Vibration. Material Assets, Landscape and Visual	Appropriate information signage will be put in place on local roads to guide residents and visitors to the use of the sustainable transport bridge, greenway and connections to other sustainable transport infrastructure.	Positive
Human health Risk of Anti-social behaviour.	Bridge and South Quay Plaza area	The public.	New infrastructure such as bridges, public plazas and bus stops can lead to new locations for anti-social behaviour to occur.	Significant negative impact	Momentary – brief effect.	Material Assets	Install 24/7 CCTV cameras across the bridge, appropriate lighting and design to consider measures to deter anti-social behaviour.	Neutral

Nature of Impact	Location	Population subsets	Nature of Impact (Extent and Context)	Impact Significance & Quality	Duration & Frequency of Impact	Interactions	Mitigation proposed	Residual Impact
Human health – Risk of Suicide	River Suir Sustainable bridge - River Suir.	Vulnerable population subsets	New bridge infrastructure over the River Suir results in a new area for suicide events to occur.	Profound negative impact	Momentary - unknown Frequency	None	Install and maintain ringbuoys as part of detailed design stage in consultation with the Irish Water Safety and search and rescue organisations in Waterford.	Very Significant Negative
Human Health – Physical Factors	Waterford City	Population and Visitors	Transport patterns that promote walking cycling and sustainable modes of travel can reduce sedentary lifestyle, increasing activity and improve health outcomes.	Significant positive	Long-term	Traffic, Air Quality and Climate, Noise and Vibration. Material Assets, Landscape and Visual	Design and maintain suitable landscaping and public realm infrastructure to complement other environmental mitigation, e.g. lighting, pleasant surroundings to discourage anti-social behaviour, graffiti, etc.	Positive

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Chapter 7
Biodiversity

ROD
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Waterford City
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Chapter 7 Biodiversity

7.1 Introduction

This chapter examines the ecology of the receiving environment within and surrounding the proposed River Suir Sustainable Transport Bridge ("the proposed development") and assesses the potential impacts of the proposed development on Biodiversity. The methods employed to establish the ecological baseline within and around the proposed development are described, together with the process followed to determine the nature conservation importance of the ecological features present. The ways in which habitats, species and ecosystems are likely to be affected by the proposed development are explained and the magnitude of the likely effects predicted, taking into account the conservation condition of the habitats and species under consideration. Mitigation and enhancement measures are also proposed, and any residual effects are assessed, taking into account the mitigation and enhancement measures proposed.

7.1.1 Conservation Legislation and Planning

The European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended) ("the Birds and Natural Habitats Regulations") transpose into Irish law Directive 2009/147/EC (the Birds Directive) and Council Directive 92/43/EEC (the Habitats Directive), which list priority habitats and species of international (European Union) conservation importance and that require protection. This protection is afforded in part through the designation of areas that represent significant populations of listed species within a European context, i.e. Natura 2000 sites. An area designated for bird species is classed as a Special Protection Area (SPA), and an area designated for other protected species and habitats is classed as a Special Area of Conservation (SAC). Wild bird species in SPAs and habitats and species listed on Annexes I and II, respectively, of the Habitats Directive in SACs in which they are designated features have full European protection. Species listed on Annex IV of the Habitats Directive are strictly protected wherever they occur, whether inside or outside the Natura 2000 network. This protection is afforded to animal and plant species by Sections 51 and 52, respectively, of the Birds and Natural Habitats Regulations. Annex I habitats outside of SACs are still considered of national and international importance and, under Article 27(4)(b) of the Birds and Natural Habitats Regulations, public authorities have a duty to strive to avoid the pollution or deterioration of Annex I habitats and habitats integral to the functioning of SPAs.

The Wildlife Act, 1976 (as amended) ("the Wildlife Acts") is the principle legislative mechanism for the protection of wildlife in Ireland. The Wildlife Acts protect species of conservation value from injury, disturbance and damage to them or to their breeding and resting places. All species listed in the Wildlife Acts must, therefore, be a material consideration in the planning process. An important piece of national legislation for the protection of wild flora, i.e. vascular plants, mosses, liverworts, lichens and stoneworts, is the Flora (Protection) Order, 2015, which makes it illegal to cut, uproot or damage listed species in any way or to alter, damage or interfere in any way with their habitats

Ireland's national biodiversity action plan *Actions for Biodiversity 2017-2021* (DAHG, 2011), in accordance with the Convention on Biological Diversity, is a framework for the conservation and protection of Ireland's biodiversity, with an overall objective to secure the conservation, including, where possible, the enhancement and sustainable use of biological diversity in Ireland and to contribute to collective efforts for conservation of biodiversity globally. Action 1.1.3 of the National Biodiversity Strategy states that "all Public Authorities and private sector bodies move towards no net loss of biodiversity through strategies, planning, mitigation measures, appropriate offsetting and/or investment in Blue-Green infrastructure". This is particularly relevant to developments. The plan is implemented through county and local development plans, legislation and statutory instruments concerned with nature conservation.

The *All-Ireland Pollinator Plan 2015-2021* (NBDC, 2015) seeks to halt the decline in pollinators through a range of objectives. This plan is supplemented by the guidance document *Councils: actions to help pollinators* (NBDC, 2016).

7.1.2 Approach and Objectives

A habitat is the environment in which an animal or plant lives and is generally defined in terms of vegetation and physical structures. Habitats and species of ecological significance occurring or likely to occur within the defined **Zone of Influence** and **study area** of the proposed development were classified as **Key Ecological Receptors**.

In accordance with Transport Infrastructure Ireland (TII) *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (2009), an impact assessment has been undertaken of Key Ecological Receptors within the Zone of Influence of the proposed development. According to these guidelines, the Zone of Influence is the "effect area" over which change resulting from the proposed development is likely to occur and the Key Ecological Receptors are defined as features of sufficient value as to be material in the decision-making process for which potential impacts are likely.

In the context of the proposed development, a Key Ecological Receptor is defined as any feature valued as follows:

- International Importance
- National Importance
- County Importance
- Local Importance (Higher Value)

Features of local importance (Lower Value) and features of no ecological value are not considered to be Key Ecological Receptors. The assessment does not consider any other type of environmental impact other than Biodiversity (Flora and Fauna).

This chapter quantifies the potential impacts on identified Key Ecological Receptors and prescribes mitigation measures required to avoid and reduce any likely significant effects.

Determining the ecological issues to be addressed for the assessment was informed by early engagement with relevant stakeholders. During this scoping process, selected consultees were provided the opportunity to input into the proposed development through preliminary discussions on Key Ecological Receptors that could potentially be affected; strategies to avoid negative impacts; and, where possible, compensation or enhancement measures. Further details of the consultation process, including a list of the statutory and non-statutory consultees, can be found in Section 7.2.5.

On completion of scoping, a desk study was undertaken to review all available published data describing the ecological conditions within the greater area of the proposed development. The desk study cross-referenced this published data with publicly available maps and aerial orthophotography from Ordnance Survey Ireland (OSi), National Parks & Wildlife Service (NPWS) and Environmental Protection Agency

(EPA) to identify Key Ecological Receptors. During preparation of this assessment, the statutory conservation agency, the NPWS, provided data on nature conservation designations, habitats and species of conservation interest. The baseline information obtained from the desk study was the first stage in defining the Zone of Influence of the proposed development.

Determining baseline ecological conditions allows an accurate prediction of the likely impacts of the proposed development on Key Ecological Receptors and an assignment of ecological significance to them.

The results of the multidisciplinary walkover survey and habitat mapping undertaken on the 8th November 2016 and 6th June 2018 are presented in Figure 7.2 in Volume 3 of this EIAR.

Where detrimental impacts were identified, detailed and specific mitigation measures have been proposed in accordance with the hierarchy of options suggested in the research for the European Commission publication; '*Assessment of plans and projects significantly affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC'*. Preference was given to avoiding impacts at their source. Where this was not possible, the following approaches were adopted, in order of decreasing preference: reduce impacts at source, abate on site, and finally abate at receptor. These measures have been incorporated into the design of the proposed development.

The information provided in this chapter accurately and comprehensively describes the baseline ecological environment, provides an accurate prediction of the likely significant ecological impacts of the proposed development, prescribes specific mitigation as necessary and describes any residual ecological effects.

7.1.3 Terminology

The valuation of Key Ecological Receptors and the terminology used to determine ecological value adheres to aforementioned guidance (TII, 2009). The definitions of impacts (e.g. description of effects) used to predict impacts and consider mitigation measures follows the definitions in the EPA's *Draft Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA, 2017).

7.2 Methodology

This section describes the methodologies that were followed in collecting information, in describing the baseline ecological conditions and in assessing the likely impacts of the proposed development.

7.2.1 Guidelines on Environmental Impact Assessment

The process of identifying, quantifying and evaluating potential impacts of the proposed development on habitats, species and ecosystems was undertaken in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) best practice guidance (CIEEM, 2018).

In addition, reference to recognised guidance on the Environmental Impact Assessment of National Road Schemes provided for an appropriately defined scope and evaluation process:

- EPA (2003) *Advice notes on Current Practice (in the preparation of Environmental Impact Statements)*. Environmental Protection Agency.
- EPA (2017) *Draft Guidelines on the Information to be Contained in Environmental Impact Statements.* Environmental Protection Agency.
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- TII (2008d) *Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes.* Transport Infrastructure Ireland.
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- TII (2010) *Guidelines on management of noxious weeds and non-native invasive plant species on national roads.* Transport Infrastructure Ireland.

7.2.2 Establishing the Zone of Influence

The key variables determining whether Key Ecological Receptors will be subject to impacts through development are: the physical distance of the Project to the Key Ecological Receptors; the sensitivities of the Key Ecological Receptors within the receiving natural environment; and, the potential for in-combination impacts. The Zone of Influence was defined as a 2km buffer around the proposed development and 10 km downstream to ensure all conceivable impacts had been captured in the assessment. The Zone of Influence is presented in Figure 7.1 in Volume 3.

7.2.3 Establishing the Study Area

The extent of the study area is defined by the ecological features likely to occur within an effects distance from the proposed development. This is informed by the findings of the desk study (presence/absence of protected habitats, flora or fauna within the Zone of Influence) and best practice methodology referenced above for assessing impacts on those ecological features. The study area included a 100m buffer around the proposed development boundary and also included species specific survey buffer zones (e.g. derogation limits for Otter where accessible and safe to do so).

7.2.4 Desk Study

The desk study undertaken for this assessment included a thorough review of the available ecological baseline data within the study area. The following resources were used:

- National Parks & Wildlife Service (NPWS) map viewer was reviewed to determine the location of national (e.g. Natural Heritage Areas) and European (e.g. Natura 2000 sites) designated sites within the Zone of Influence of the proposed development;
- National Biodiversity Data Centre (NBDC) map viewer provided protected species data;
- Irish Wetland Bird Survey Site data (I-WeBS);
- Birds of Conservation Concern (BoCCI) in Ireland 2014-2019 (Colhoun & Cummins, 2013);
- Environmental Protection Agency (EPA) Unified GIS Application provided data in relation to the Water Framework Directive Risk/Status of waterbodies and watercourses in the Zone of Influence;
- Aardwolf Wildlife Surveys Bat Fauna Study (Kelleher, 2014);
- R & H Hall Flour Mill, Ferrybank, Waterford City - Bat survey report (Harrington, 2017);
- Inland Fisheries Ireland (IFI) Fish Sampling Records (www.fisheriesireland.ie); and,
- Hydraulic Modelling of the Proposed River Sustainable Transport Bridge (Hydro Environmental Ltd., 2018).

As with all desk studies, the data considered were only as good as the data supplied by the recorders and recording schemes. The recording schemes provide disclaimers in relation to the quality and quantity of the data they provide, and these were considered when examining outputs of the desk study.

7.2.5 Consultation

The statutory and non-statutory consultees listed in Table 7.1 were contacted and invited to submit any observations in relation to the proposed development. Consultees were also provided with a drawing showing the proposed development.

The purpose of the consultations was to:

- Identify any relevant information that consultees held, including the presence of data on protected species or species of conservation concern;
- Identify any concerns that consultees may have about the proposed development; and,

- Identify any issues that the consultees would like to see addressed during the ecological impact assessment process.

Organisations or individuals consulted in relation to ecology and nature conservation, together with a summary of responses, are listed in Table 7.1. In each case, only the responses relevant to this chapter have been included. Following initial consultation, meetings were held with the statutory consultees, the National Parks & Wildlife Service and Inland Fisheries Ireland. All issues raised by the consultees have been addressed as fully as possible in this chapter.

Table 7.1 Consultation Responses

Consultee	Date Correspondence Received	Summary of Response
Statutory Consultees		
National Parks & Wildlife Service	3rd March 2017	Provided rare and protected species recorded.
	17th October 2018	The main concerns of the NPWS were impacts arising from the proposed development to Qualifying Interests of Lower River Suir SAC, particularly Twaite Shad. The NPWS was also concerned about impacts to birds though birdstrike. The NPWS requested an Otter survey be undertaken and that consideration be given to invasive species in the assessment. A meeting with NPWS was held on the 9th October 2018.
Inland Fisheries Ireland	15th March 2017	IFI provided detail on the movements of fish species through the Barrow and Suir Estuaries. IFI noted that bilge water from barges poses a risk of importing invasive species e.g., Chinese Mitten Crab. Meetings were held with IFI on the 17th July 2018. IFI were also present at the meeting with the NPWS on the 9th October 2018.
Non-statutory Consultees		
Waterford City & County Council Heritage Officer	22nd March 2018	The Heritage Officer noted that Otter and Dolphin are known to occur in the River Suir. The Heritage Officer also stated that there is no evidence of an established Chinese Mitten Crab population in Waterford Estuary since the first record of the species in 2006.
Coastwatch Ireland	6th March 2017	Coastwatch's main concerns were that construction works could cause further spread of the Chinese Mitten Crab within Waterford Estuary and that disinfection stations should be set up on both sides of the river to prevent further spread. They also noted that work in the river could result in siltation and lead to the introduction of toxins and heavy metals into the river ecosystem. Coastwatch highlighted that disturbance to algae and invertebrates on existing pylons could impact on a valuable fish nursery. Coastwatch also indicated that consideration should be given to European eel if any works were to be carried out on the river bed. They also observed that there are algal species on the southern quay and some noteworthy floral species growing on the northern quay wall.

Consultee	Date Correspondence Received	Summary of Response
Birdwatch Ireland	21st April 2017	Provided monthly counts for Suir subsites. The results are summarised in Section 7.3.3 of this EIAR.
Irish Whale & Dolphin Group	2nd March 2018	Provided Marine Mammal Risk Assessment (Appendix 7.1) which concluded that it is extremely unlikely that marine mammals would be impacted by the proposed development.
Bat Conservation Ireland	N/A	No Response

7.2.6 Ecological Survey Methodology

Following the desk study, field surveys were conducted adhering to the following guidelines:

- Guidelines for Ecological Survey Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (TII, 2008b);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (TII, 2009); and
- Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2011).

The multidisciplinary walkover survey classified habitats according to *A Guide to Habitats in Ireland* (Fossitt, 2000) and identified any habitats corresponding to Annex I of the Habitats Directive using the *Interpretation Manual of European Union Habitats* (European Commission, 2013).

7.2.7 Multidisciplinary Walkover Survey

The multi-disciplinary walkover survey included habitat mapping, aimed to detect the presence, or likely presence, of a range of protected species. The presence (or signs) of protected fauna, including birds, mammals, amphibians and reptiles was noted during the visits. The multi-disciplinary walkover survey provided baseline information regarding the existing ecology of the study area and informed the need for further specialist species-specific survey work. The multi-disciplinary walkover survey was undertaken on the 8th November 2016 and was updated by repeat site visit on the 6th June 2018. The surveys were undertaken by ROD ecologists Patrick O'Shea, Owen O'Keefe and Kate Moore. All ROD ecologists are members of the Chartered Institute of Ecology and Environmental Management (CIEEM) and have six, three and three years' experience in ecological survey and impact assessment respectively.

The desk study and initial walkover survey identified Key Ecological Receptors in the study area. The following sections outline the methodologies followed during the ecological surveys.

7.2.8 Habitat Survey

The habitat survey was conducted as part of the multidisciplinary walkover surveys and in accordance with best practice guidance (Smith et al., 2011). Due to the urban and built nature of the habitats within the site, the use of detailed botanical surveys to evaluate percentage vegetation cover and habitat status was not deemed necessary. The site was instead systematically and thoroughly walked, and habitats were assessed, classified and sketched on to field maps, Habitats were identified in accordance with the Heritage Council's 'Guide to Habitats in Ireland' (Fossitt, 2000).

7.2.9 Survey of Watercourses

The proposed development will traverse the River Suir. An aquatic ecological assessment was undertaken for the proposed development during the multidisciplinary walkover surveys. A review of literature and IFI fish sampling data in relation to the aquatic environment of the River Suir catchment was undertaken. The survey targeted specifically the presence or suitability of the River Suir in the vicinity of the proposed bridge as spawning habitat for fish species. The survey also aimed to confirm the presence and the likely presence of qualifying interests of the Lower River Suir SAC such as Atlantic Salmon, Twaite Shad, Lamprey and Otter.

7.2.10 Otter

The function of the Otter survey was to identify any sensitive features within the study area potentially of use to breeding, resting, foraging or commuting Otter and to establish presence or absence of Otter activity.

The Otter survey was conducted adhering to best practice guidance (TII, 2008c) and involved a systematic search of the river banks for physical evidence of Otter e.g. spraints, prints, slides, trails, couches and holts. The survey methodology was also cognisant of the recommendations in the Otter Threat Response Plan 2009-2011 (NPWS, 2009) which recognises the importance of the riparian buffer (10 m on both banks) for Otter.

7.2.11 Bats

Bat Suitability Assessment

A Bat suitability assessment was undertaken during the multidisciplinary walkover survey to identify built or natural features in the study area with potential to support a Bat roost.

The Bat suitability assessment was conducted adhering to best practice guidance (TII2006a; 2006b, Collins (Eds.), 2016) and involved a visual assessment and categorisation of highly suitable features on trees and buildings capable of supporting roosting Bats within the study area. Trees and buildings were assessed using the recognised criteria outlined in Collins (Eds.), 2016). The locations of buildings and trees with any natural holes, cracks/splints in major limbs, loose bark or hollows/cavities that could provide low to high potential were recorded with high definition Geographical Position System (GPS). Linear landscape features (e.g. mature Treelines and Hedgerows) with potential to provide important foraging and commuting habitat for Bats were also recorded and geospatially referenced.

Bat Activity Survey

In order to supplement the bat survey undertaken in 2017 (Harrington, 2017), a bat activity survey was conducted adhering to best practice guidance (TII, 2006a; 2006b; Collins (Eds.), 2016) in July 2018. The survey involved walking adjacent to the River Suir to observe and record bat activity in the study area. This survey was used to identify the species and the level of activity close to the proposed development. The bat activity survey was undertaken between sunset and two hours after sunset. Health and Safety policy dictated that surveyors operated in pairs. During the survey, the transect was walked slowly using an Anabat Walkabout bat Detector to record bat echolocations. The bat Detector allows visual validation of echolocation recordings (species/species group identification) in real time.

7.2.12 Badger

The Badger survey was conducted in order to determine the presence or absence of Badger within the study area. The Badger survey was conducted adhering to best practice guidance (TII, 2006c; 2009) and involved a systematic search for physical evidence of Badger e.g. setts, latrines, badger paths of the full extent of the study area of the proposed development in November 2016. The optimal period for Badger surveys is during seasonal peaks in territorial activity and when vegetation cover is at a minimum (January to April and less pronounced peak in October).

7.2.13 Marine Mammals

The Irish Whale and Dolphin Group (IWDG) were contracted by Roughan and O'Donovan, on behalf of Waterford City and County Council, to carry out a Marine Mammal Risk Assessment (MMRA) of the proposed development. The MMRA is provided in Appendix 7.1.

7.2.14 Other Mammals, Reptiles and Amphibians

During the walkover survey the potential for the study area to support additional protected mammals, reptiles and amphibians was assessed. Given that the study area is in a highly urbanised setting subject to disturbance and no evidence of these species was recorded it was deemed that additional species-specific surveys were not required.

7.2.15 Birds

The habitats within the study area do not support important assemblages or significant populations of birds. Similarly, given that the site is located in the centre of Waterford City, the terrestrial habitats are hard surfaces and the area is subject to extensive anthropogenic disturbance, bird sampling techniques such as those recommended by Bibby et al. (2000) were not required.

7.2.16 Fisheries and Aquatic Fauna

The River Suir was assessed with regard to its potential to support fish including but not limited to salmonids and lamprey. A desk study review of literature pertinent to the aquatic environment was conducted. This included a review of records from IFI's fish sampling, conducted under the Water Framework Directive (WFD). A review of the EPA Q-value status and WFD surface water status for the watercourses was also undertaken.

Detailed fish stock surveys were not conducted given that significant impacts to fisheries are not anticipated. This followed best practice guidance (TII, 2009) which states that "*It will only be appropriate to undertake detailed surveys where significant impacts are anticipated on potentially valuable assemblages of fish, or important populations of a particular species.*"

Dedicated surveys of Freshwater Pearl Mussel and White-clawed Crayfish were not deemed necessary. The proposed development is located in a tidal river and these species are exclusively freshwater.

7.2.17 Invasive Alien Plant Species

During the walkover surveys, the presence of invasive species was recorded. The focus was on identifying species subject to restrictions under Section 49 of the Birds and Natural Habitats Regulations. Target notes were taken of any invasive species identified. Information recorded included the area of infestation, plant condition, height and location. Site features that could affect control measures such as adjacent land use, structures and services were also recorded.

7.2.18 Ecological Evaluation and Impact Assessment Methodology

The ecological evaluation and impact assessment within this chapter follows the methodology that is set out in '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes*' (TII, 2009).

7.2.19 Evaluation of Ecological Resources

The criteria used for the ecological evaluation follows those set out in Section 3.3 of TII (2009). These guidelines set out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular site is of importance on the following scales:

- International
- National
- County
- Local Importance (Higher Value)
- Local Importance (Lower Value)

This guidance clearly sets out the criteria by which each geographic level of importance can be assigned. For example, Locally Important (Lower Value) receptors contain habitats and species that are widespread and of low ecological significance and only of importance in the local area. Conversely, Internationally Important receptors are either designated for conservation as part of the Natura 2000 network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected fauna.

All habitats and species within the Zone of Influence and study area were assigned a level of significance on the above basis and Key Ecological Receptors were established and classified on this basis.

7.2.20 Impact Assessment Methodology

The impact assessment uses the EPA (2017) guidelines for characterising the impact that the proposed development would have on the receiving environment. The parameters used to characterise impacts were:

- Magnitude - relates to the quantum of impact, for example the number of individuals affected by an activity;
- Extent - relates to the area over which the impact occurs;
- Duration - intended to refer to the length of time for which the impact is predicted to continue, until recovery or re-instatement;
- Reversibility - whether an impact is ecologically reversible, either spontaneously or through specific action; and,
- Timing/frequency of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and associated impacts) would take place can be an important determinant of the impact on receptors.

It is necessary to ensure that any assessment of impact takes account of construction and operational phases; direct, indirect and cumulative impacts; and, those that are temporary, reversible and irreversible. The most relevant criteria for assessment of effect include quality and significance and these criteria are defined in Tables 7.2. and 7.3. The following terms are defined when quantifying duration (EPA, 2017):

- Temporary – up to 1 year
- Short-term – 1 to 7 years
- Medium-term – 7 to 15 years
- Long-term – 15 to 60 years
- Permanent – over 60 years

Table 7.2 Criteria for Assessing Impact Significance Based on (EPA, 2017)

Impact Magnitude	Definition
No change	No discernible change in the ecology of the affected feature
Imperceptible Impact	An impact capable of measurement but without noticeable consequences
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends
Significant Impact	An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment
Profound Impact	An impact which obliterates sensitive characteristics

Table 7.3 Criteria for Assessing Impact Quality Based on (EPA, 2017)

Impact Type	Criteria
Positive	A change which improves the quality of the environment e.g. increasing species diversity, improving reproductive capacity of an ecosystem or removing nuisances
Neutral	A change which does not affect the quality of the environment
Negative	A change which reduces the quality of the environment e.g. lessening species diversity or reducing the reproductive capacity of an ecosystem

Once the potential impacts are characterised, the significance of any such impacts on the identified Key Ecological Receptors is determined.

7.2.21 Process of Asessing Significance

The significance of impacts was determined following guidance set out in the TII Ecological Impacts Assessment Guidelines (2009), whereby impacts are assigned significance based on their characterisation, irrespective of the value of the receptor. Significance is determined by effects on conservation status or integrity, regardless of geographical level at which these would be relevant.

7.2.22 Mitigation

The proposed development has been designed to specifically avoid, reduce and minimise impacts on all Key Ecological Receptors. Where potential impacts on Key Ecological Receptors are predicted, mitigation has been prescribed to ameliorate such impacts.

Proposed best practice design and mitigation measures are specifically set out in this chapter and are realistic in terms of cost and practicality. Provided measures follow the prescribed methodologies and best practice where available, they have a high probability of success in terms of addressing the impacts on the identified Key Ecological Receptors.

The potential impacts of the proposed development were considered and assessed to ensure that all impacts on Key Ecological Receptors are adequately addressed and no significant residual impacts remain following mitigation.

7.2.23 Survey Limitations

Standard survey methods were followed. However, any biases or limitations associated with these methods could potentially affect the results collected. Whilst every effort was made to provide a full assessment and comprehensive description of the study area, population fluctuations may not be fully reflected due to the instantaneous nature of the field surveys. However, the field surveys together with the background knowledge provided by the desk study, provides a robust representation of the baseline for the habitats and species within the Zone of Influence.

7.3 Desk Study Results

7.3.1 General Description and Context

The proposed 5-span, 8m wide bridge for pedestrians, cyclists and a public transportation service. The bridge site location will be located approximately in line with Barronstrand Street and in front of the existing clock tower.

The sustainable transport bridge crossing point is approximately 550m downriver of Rice Bridge. The river is in the region of 207m wide at this location, measured between the edge of the South Quay and the shore edge of the north side wharf and is part of the Lower River Suir Special Area of Conservation (SAC).

The channel has a maximum bed level of approximately -12mOD resulting in typical water depths of 10-14m in the central river zone. The South Quays area at the proposed bridge location currently consists of the Clock Tower monument and car parks whilst the North Quays is a former industrial brownfield site to be developed as part of the Strategic Development Zone (SDZ).

A minimum deck soffit level of 3.7mOD at the South Quays is proposed which provides the 500mm free board required above combined 1% Annual Exceedance Probability (AEP) fluvial and 0.5% AEP tidal flood (obtained from "Suir CFRAM Study, Hydraulics Report, July 2015"). In addition, the proposed deck level at the South Quay (the lowest point of the deck) provides approximately 250mm free board above 3.47mOD level, which is the design flood level (200 year tide + 100 year fluvial Flood) obtained by the hydraulic model developed for the North Quays SFRA and bridge OPW Section 50.

The highest point of the deck will be at the bridge approach on the North Quay (+8.0mOD at the top of pavement level). Here, the vertical alignment is flat with the gradient gradually increases from 0.0% on the North Quay approach to a maximum of 3.4% at the South Quay approach (1 in 28 slope), where the walkway level of +4.2mOD at the centreline of the bearing is reached.

The proposed bridge design provides a smooth transition between the +8.0mOD level on the North Quay and the +4.2mOD level on the South Quay.

River Navigation

A 32.5m clear span bridge opening section has been provided for river traffic which creates a 25m wide navigation channel. The existing lifting span control building for Rice Bridge will be used for the proposed River Suir Sustainable Transport Bridge. Design vessel characteristics and any independent ship impact protection required along the line of the navigational channel have been discussed with the Waterford Port. The design of the proposed vessel collision protection system is presented in Figures 4.2, 4.4 and 4.5 of Volume 3 of this EIAR and the details of which are discussed in Section 4.7.4.3 of this chapter.

The passing of small crafts will be feasible without opening the lifting span. The bridge deck at this location will have an underside of deck level of 5.22mOD which will provide vertical clearances of 7.42m at low tide (-2.2mOD) and 2.82m at the typical high tide (+2.4mOD).

Purpose of Providing the Proposed Development

The proposed bridge is required to stimulate the coherent development of the city's various quarters, in particular integrating the substantial housing areas in Ferrybank and Bellfield and the proposed North Quays SDZ redevelopment with the city centre.

The bridge is to be located in line with Barronstrand Street to provide a continuous link connecting the city centre retail spine to the North Quays and beyond.

The proposed bridge across the River Suir will be a public amenity offering greater appreciation and enjoyment of the river. In order to develop a transport facility that will permit and encourage sustainable development, a user hierarchy of pedestrians, cyclists and public transport will be adopted. The proposed bridge will be a sustainable transport bridge that connects into the existing road infrastructure in a logical and safe manner.

The development will take cognisance of the cycling strategy for the city and also the National Transport Authority's (NTA's) National Cycle Manual.

The proposed development is not directly connected with or necessary for the management of any European site.

At present, the North Quays comprise an assembly of wharves consisting of disused open spaces. The disused Rosslare-Waterford railway line crosses the site in an east-west direction and it is proposed that a greenway will be constructed along the old railway line. The South Quay setting currently comprises a car park that is adjacent to the R680, within which a clock tower monument stands. A marina is also located on the river at this point.

The River Suir itself, although highly modified, is the habitat of most biodiversity value in the vicinity of the proposed development. In Waterford City, the river is designated as part of the Lower River Suir SAC. The river is of ecological importance as it contains examples of Annex I habitats and supports populations of Annex II species.

7.3.2 Designated Sites

The NPWS map viewer was reviewed for the location of designated sites within the Zone of Influence. The proposed development traverses the Lower River Suir SAC and is hydrologically connected to the River Barrow and River Nore SAC, the King's Channel pNHA and the Barrow River Estuary pNHA. The detailed Site Synopses, Natura 2000 data forms and Conservation Objectives for the Lower River Suir SAC and the River Barrow and River Nore SAC were reviewed as part of the assessment. Designated sites within the Zone of Influence are presented in Table 7.4.

Table 7.4 Designated sites within the Zone of Influence

Designated Site	Distance from proposed development	Description
European Sites		
Lower River Suir SAC [002137]	Immediate proximity	This site consists of the freshwater stretches of the River Suir immediately south of Thurles, the tidal stretches as far as the confluence with the Barrow/Nore immediately east of Cheekpoint in Co. Waterford. The Suir and its tributaries flow through the counties of Tipperary, Kilkenny and Waterford. The Lower River Suir contains excellent examples of a number of Annex I habitats, including the priority habitats alluvial forest and Yew woodland. The site also supports populations of several important animal species; some listed on Annex II of the Habitats Directive or listed in the Irish Red Data Book. The presence of two legally protected plants (Flora (Protection) Order, 2015)

Designated Site	Distance from proposed development	Description
		and the ornithological importance of the site adds further to the ecological interest and importance.
River Barrow and River Nore SAC [002162]	8km downstream	This site comprises the River Barrow and River Nore catchments from the source in the Slieve Bloom Mountains to Creadan Head in Waterford. Urban centres along the site include Portarlington, Athy, Carlow, Kilkenny and New Ross. Overall, it is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the Habitats Directive. Furthermore, it is of high conservation value for its populations of a number of bird species listed on Annex I of the Birds Directive. The occurrence of several Red Data Book plant species and the endemic population of the hard-water form of the Freshwater Pearl Mussel (limited to a 10 km stretch of the Nore) add further value to this site.
Nationally Designated Sites		
King's Channel pNHA [001702]	3.1km downstream	An offshoot of the Suir Estuary below Waterford surrounding Little Island, where the southern shore is lined in places by a flat saltmarsh. The saltmarsh is best developed in Grantstown with a sequence of plant communities. The middle zone has a few clumps of protected (Flora Protection Order, 2015) Meadow Barley (*Hordeum secalinum*)
Barrow River Estuary pNHA [000698]	9.2km downstream	No site synopsis available for this pNHA. See River Barrow and River Nore SAC.

With regard to European sites, an Appropriate Assessment (AA) Screening was carried out by Waterford City and County Council, as the competent authority, for the proposed development in compliance with Article 6(3) of the Habitats Directive. As part of this assessment, the potential for the proposed development to have an effect on any European sites in the Zone of Influence was considered. The AA Screening concluded as follows:

> *"It has been concluded, in view of the best scientific knowledge and the Conservation Objectives of the Lower River Suir SAC and the River Barrow and River Nore SAC, that the Project, on its own or in combination with other plans or projects, has the potential to give rise to likely significant effects on the Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC.*
>
> *Significant effects are potentially likely to arise as a result of construction works within close proximity to the River Suir and direct impacts cannot be objectively ruled out. Piling within the Lower River Suir SAC is likely to result in a temporary increase in suspended solids. In our opinion, the overall conclusion is that construction of the River Suir Sustainable Transport Bridge cannot be "screened out"."*

As a consequence of the determination of the AA Screening, a Natura Impact Statement (NIS) has been prepared in respect of the proposed development, detailing the impacts predicted on the Lower River Suir SAC and River Barrow and River Nore

SAC and proposing appropriate measures to mitigate for those impacts. The locations of the designated sites are displayed in Figure 7.1 of Volume 3 of this EIAR.

No pathways for significant impacts were identified in relation to the nationally designated sites as set out in Table 7.4 above. None of the nationally designated sites within the Zone of Influence were considered as Key Ecological Receptors in their own right.

7.3.3 Habitats, Flora and Fauna

The desk study also identified which important habitats and species historically occurred and are, therefore, likely to occur within the Zone of Influence and study area. The following sections give an overview of the results of the desk study.

National Parks & Wildlife Service Data

Table 7.5 lists rare and protected species records obtained from NPWS in March 2017.

Table 7.5 Records for Rare and Protected Species, NPWS

Common Name	Scientific Name	Status
Mammals		
Irish Hare	*Lepus timidus hibernicus*	Annex V HD, WA
Otter	*Lutra lutra*	Annexes II, IV HD, WA
Badger	*Meles meles*	WA
Stoat	*Mustela erminea hibernica*	WA
Hedgehog	*Erinaceus europaeus*	WA
Grey Seal	Halichoerus *grypus*	Annex II HD, WA
Reptiles & Amphibians		
Common Lizard	*Zootoca vivipara*	WA
Smooth Newt	*Lissotriton vulgaris*	WA
Common Frog	*Rana temporaria*	Annex V HD, WA
Fish		
Twaite Shad	*Alosa fallax*	Annexes II, IV HD, WA
Invertebrates		
Freshwater Pearl Mussel	*Margaritifera margaritifera*	Annexes II, IV, WA
Plants		
Betony	*Stachys officinalis*	FPO 2015
Opposite-leaved Pondweed	*Groenlandia densa*	FPO 2015
Divided Sedge	*Carex divisa*	FPO 2015
Meadow Barley	*Hordeum secalinum*	FPO 2015
Borrer's Saltmarsh-grass	*Puccinellia fasciculata*	FPO 2015

Status (listing conferring protection or describing conservation status) abbreviations: Annex II/IV/V (non-avian species) = Habitats Directive (HD); WA = Wildlife Acts 1976 (as amended); FPO = Flora (Protection) Order 2015.

Biodiversity Ireland Database

Table 7.6 lists the rare and protected species recorded by the NBDC within the hectads pertaining to the current study area. To avoid replication, all records of species represented in the NPWS dataset have been removed from the displayed NBDC data. Table 7.7 lists the Invasive Alien Species (IAS) recorded within these hectads.

Table 7.6 NBDC Records from within the Zone of Influence.

Common name	Scientific name	Status
Mammals		
Daubenton's Bat	*Myotis daubentonii*	HD-IV
Leisler's Bat	*Nyctalus leisleri*	HD-IV
Common Pipistrelle	*Pipistrellus pipistrellus*	HD-IV
Soprano Pipistrelle	*Pipistrellus pygmaeus*	HD-IV
Brown Long-eared Bat	*Plecotus auritus*	HD-IV
Red Squirrel	*Sciurus vulgaris*	WA
Pygmy Shrew	*Sorex minutu*	WA
Invertebrates		
Marsh Fritillary	*Euphydryas aurinia*	HD-II
Birds		
Kingfisher	*Alcedo atthis*	BD-I; BoCCI-Amber
Hen Harrier	*Circus cyaneus*	BD-I; BoCCI-Amber
Merlin	*Falco columbarius*	BD-I; BoCCI-Amber
Bar-tailed Godwit	*Limosa lapponica*	BD-I; BoCCI-Amber
Whooper Swan	*Cygnus cygnus*	BD-I; BoCCI-Amber
Short-eared Owl	*Asio flammeus*	BD-I; BoCCI-Amber
Dunlin	*Calidris alpina*	BD-I; BoCCI-Red
Nightjar	*Caprimulgus europaeus*	BD-I; BoCCI-Red
Goldeneye	*Bucephala clangula*	BoCCI-Red
Eurasian Curlew	*Numenius arquata*	BoCCI-Red
Northern Lapwing	*Vanellus vanellus*	BoCCI-Red
Gadwall	*Anas strepera*	BoCCI-Amber
Northern Shoveler	*Anas clypeata*	BoCCI-Red
Wigeon	*Anas penelope*	BoCCI-Red
Pochard	*Aythya ferina*	BoCCI-Red
Grey Partridge	*Perdix perdix*	BoCCI-Red
Golden Plover	*Pluvialis apricaria*	BoCCI-Red
Eurasian Woodcock	*Scolopax rusticola*	BoCCI-Red
Greylag Goose	*Anser anser*	BoCCI-Amber
Tufted Duck	*Aythya fuligula*	BoCCI-Red
Coot	*Fulica atra*	BoCCI-Amber
Eurasian Teal	*Anas crecca*	BoCCI-Amber
Yellowhammer	*Emberiza citrinella*	BoCCI-Red
Black-headed Gull	*Larus ridibundus*	BoCCI-Red
Herring Gull	*Larus argentatus*	BoCCI-Red
Barn Owl	*Tyto alba*	BoCCI-Red
Sand Martin	*Riparia riparia*	BoCCI-Amber

Common name	Scientific name	Status
Shelduck	*Tadorna tadorna*	BoCCI-Amber
Cormorant	*Phalacrocorax carbo*	BoCCI-Amber
Spotted Flycatcher	*Muscicapa striata*	BoCCI-Amber
Starling	*Sturnus vulgaris*	BoCCI-Amber
Wheatear	*Oenanthe oenanthe*	BoCCI-Amber
Little Grebe	*Tachybaptus ruficollis*	BoCCI-Amber
Common Sandpiper	*Actitis hypoleucos*	BoCCI-Amber
Sky Lark	*Alauda arvensis*	BoCCI-Amber
Swift	*Apus apus*	BoCCI-Amber
Red Knot	*Calidris canutus*	BoCCI-Amber
Linnet	*Carduelis cannabina*	BoCCI-Amber
Mute Swan	*Cygnus olor*	BoCCI-Amber
House Martin	*Delichon urbicum*	BoCCI-Amber
Common Kestrel	*Falco tinnunculus*	BoCCI-Amber
Eurasian Oystercatcher	*Haematopus ostralegus*	BoCCI-Amber
Swallow	*Hirundo rustica*	BoCCI-Amber
Lesser Black-backed Gull	*Larus fuscus*	BoCCI-Amber
Great Black-backed Gull	*Larus marinus*	BoCCI-Amber
Reed Warbler	*Acrocephalus scirpaceus*	BoCCI-Amber
Pied Flycatcher	*Ficedula hypoleuca*	BoCCI-Amber
Black-tailed Godwit	*Limosa limosa*	BoCCI-Amber
House Sparrow	*Passer domesticus*	BoCCI-Amber
Great Crested Grebe	*Podiceps cristatus*	BoCCI-Amber

Table 7.7 Invasive Species Recorded within the Zone of Influence

Common name	Scientific name
Japanese Knotweed	*Fallopia japonica*
Himalayan Balsam	*Impatiens glandulifera*
Three-cornered Leek	*Allium triquetrum*
Giant Knotweed	*Fallopia sachalinensis*
Himalayan Knotweed	*Persicaria wallichii*
New Zealand Pigmyweed	*Crassula helmsii*
Rhododendron	*Rhododendron ponticum*
Spanish Bluebell	*Hyacinthoides hispanica*
Water Fern	*Azolla filiculoides*
Common Cord-grass	*Spartina anglica*
Chinese Mitten Crab	*Eriocheir sinensis*
American Mink	*Mustela vison*
Sika Deer	*Cervus nippon*
Eastern Grey Squirrel	*Scirius carolinensis*
Brown Rat	*Rattus norvegicus*

Birds

BirdWatch Ireland provided Irish Wetland Bird Survey (I-WeBS) data for the three subsites close to the proposed development. The subsites and the years for which data was received are present in Table 7.8 below:

Table 7.8 I-WeBS Subsites reviewed

Subsite Name	Subsite Code	Years of Surveys
Fiddtown Bridge (only)	OM303	2010/11; 2011/12; 2012/13
Derrigal-Portnascully	OM361	2009/10; 2010/11; 2011/12; 2012/13; 2013/14
Barrow Bridge-Passage East	OM496	2009/10; 2011/12; 2013/14

Subsites OM303 and OM361 are situated along the River Suir, at least 15km upstream of Waterford City. These sites consist of fields which provide habitat for wetland water birds. Nationally important numbers of Teal (2011/12) and Greylag Goose (2009/10; 2010/11; 2011/12; 2012/13; 2013/14) have been recorded at these sites. No species occurring in Nationally Important numbers have been recorded in subsite OM496, which is 10km downstream of the proposed development. There was no data available from subsites OM390 or OM498.

The I-WeBS data shows that subsites OM303 and OM361 are used by large numbers of wintering birds, however, the fact that the proposed development is located in an existing urban environment with an existing bridge 550m upstream of the proposed bridge, flight paths of wintering birds will be unaffected.

The main causes of bird collisions with man-made structures are normally considered to be invisibility, particularly at night; deception, caused by glazing in buildings; and confusion, caused by light refracted or reflected by mist (Jaroslow, 1979). Structures that do not exhibit these features are rarely implicated in scientific literature as agents of bird mortality.

The proposed bridge has been designed to avoid the use of features that are a potential hazard to birds. The main crossing spans are straight. No structures generally considered hazardous to birds, such as pylons and cables, are included in the design of this bridge. The lighting design ensures that the bridge will be clearly visible to birds at night.

For the reasons outlined above, Birds have not been included as a Key Ecological Receptor for the proposed development.

Bat Survey

A bat fauna study of the north quays site (Kelleher, 2014) included a desk study, details of which are outlined below.

The existing bat records within 10km of the proposed development (sourced from BCI's National Bat Records Database) reveals that seven of the ten known Irish species have been observed locally. These include Common Pipistrelle (*Pipistrellus pipistrellus*) and Soprano Pipistrelle (*Pipistrellus pygmaeus*), Leisler's Bat (*Nyctalus leisleri*), Brown Long-eared Bat (*Plecotus auritus)*, Daubenton's Bat (*Myotis daubentonii)*, Natterer's (*Myotis nattereri*) and Whiskered Bat (*Myotis mystacinus*) as shown in Table 7.9. Roosts of some of these species are also known within this radius but none are in the vicinity of the proposed development.

Table 7.9 Status of Bat Species within 10km of the proposed development

Common name	Scientific name	Presence	Roosts	Source
Common pipistrelle	*Pipistrellus pipistrellus*	Present	3 known	BCIreland
Soprano pipistrelle	*Pipistrellus pygmaeus*	Present	1 known	BCIreland
Nathusius' pipistrelle	*Pipistrellus nathusii*	Potential - rare	0 known	BCIreland
Leisler's bat	*Nyctalus leisleri*	Present	4 known	BCIreland
Brown long-eared bat	*Plecotus auritus*	Present	3 known	BCIreland
Lesser horseshoe bat	*Rhinolophus hipposideros*	Absent	N/A	BCIreland
Daubenton's bat	*Myotis daubentonii*	Present	0 known	BCIreland
Natterer's bat	*Myotis nattereri*	Present	1 known	BCIreland
Whiskered bat	*Myotis mystacinus*	Present	2 known	BCIreland
Brandt's bat	*Myotis brandtii*	Potential - rare	0 known	BCIreland

Source: Aardwolf Wildlife Surveys Bat Fauna Survey Kelleher (2014)

A bat study was undertaken by Andrew Harrington on behalf of Waterford City and County Council prior to the demolition of buildings on the north quays in June and July 2017 (Harrington, 2017). During the surveys on the 1st July 2017 (dusk) and 2nd July 2017 (dawn), only one Pipistrelle bat was recorded on the north quays.

Marine Mammals

No sightings or evidence of any marine mammals were recorded during the walkover survey. However, occasional sightings of cetaceans and pinnipeds, e.g. Harbour Porpoise (*Phocoena phocoena*) and Grey Seal (*Halichoerus grypus*) in Waterford Harbour, have been reported (SEA, Environmental Report, Waterford City and County Development Plan 2013-2019).

A Marine Mammal Risk Assessment (MMRA) (Appendix 7.1) was undertaken by IWDG to inform this EIAR. Most sightings of cetaceans (whale, dolphin and porpoises) were recorded downriver of Waterford City in the upper reaches of the estuary. In reference to pinnipeds (seals), the MMRA reports that there were no Harbour Seal (*Phoca vitulina*) haul-out or breeding sites recorded near Waterford City while pupping and haul out site for Grey Seal occur 40km from the proposed development at Great Saltee Island.

The MMRA concluded that "*a number of marine mammals have been recorded in the River Suir, in and adjacent to Waterford city but their occurrence is so sporadic that it is extremely unlikely that any would be exposed to potential impacts from this development. No mitigation is required*".

Benthic Habitats

Ground Investigations were undertaken to characterise the riverbed in 2018 and are described in full in Chapter 8: Soils and Geology. The riverbed is characterised by soft sediment, sands and gravel varying in thickness from 1.2m to 20.7m. The thickness of the alluvial material increases from north to south.

An inshore benthic survey of Waterford Harbour was carried out for the NPWS by Atlantic RMS Ltd. in July 2008 (Kennedy, 2008). Sample station 1, immediately downstream Rice Bridge was the closest station to the proposed development. At this point the sediment was approximately 75% sand and 25% mud with gravel, cobbles and dredge spoil also being observed. The benthic habitat at the proposed development location was classified as level 5 biotope infralittoral fluid mobile mud in variable salinity. Records in the field described this habitat as laminated mud or sand layers deposited on the mud.

The benthic fauna was low in diversity and numbers, most likely due to the stress of the variable salinity, shallow water depth and associated resuspension of sediments by wind and tidal disturbance. This is typical for shallow infralittoral sediments that are exposed to wind driven and tidal disturbance. Six species were identified in the samples including a species of bivalve, a species of small crustacean and four species of worms and bristle worms.

The proposed development will lead to direct and indirect impacts on benthic invertebrates during the construction phase. The impacts on benthic invertebrates will be localised and temporary in nature, and the abundance and species diversity will return to normal within approximately one year.

Fisheries and Aquatic Fauna

The River Suir catchment is internationally important for the presence of fish species including Twaite Shad (*Alosa fallax*), Atlantic Salmon (*Salmo salar*), Lamprey species, European Eel (*Anguilla anguilla*) and European Smelt (*Osmerus eperlanus*). All of these fish species are sensitive to water quality and lighting impacts. As the proposed development provides for such impacts, Migratory Fish have been included as Key Ecological Receptors of the proposed development. The status and occurrence of these species within the study area is described below.

Twaite Shad

Twaite Shad is a Qualifying Interest for the Lower River Suir SAC and the River Barrow and River Nore SAC. The River Suir at the location of the new bridge is used by juvenile Twaite Shad. Adult shad move from the sea into estuaries in spring and spawn just above the top of tidal waters in May and June. The Lower River Suir is one of only three known spawning grounds in the country for Twaite Shad. The species is classed vulnerable to extinction in Ireland, and anecdotal reports indicate a substantial decline in the River Suir (King et al, 2011). Given the proximity of Twaite Shad habitat in relation the proposed development, the species could potentially be impacted by the proposed development.

Atlantic Salmon

Atlantic Salmon is a Qualifying Interest of the Lower River Suir SAC and the River Barrow and River Nore SAC. Salmonids require unimpeded passage through the estuary. While the River Suir at the location of the new bridge crossing and immediately downstream does not provide suitable spawning gravels for Salmonid species (salmon and trout), Atlantic Salmon could be impacted by reduced water quality as a result of accidental pollution.

Lamprey

All three Lamprey species are Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC. Sea Lamprey (*Petromyzon marinus*) and River Lamprey *(Lampetra fluviatilis*) are both likely to be present at the proposed development location in significant numbers as they move upstream to their spawning grounds. The major movement of Sea Lamprey occurs in May and June while that of River Lamprey occurs somewhat earlier, throughout the winter and in early spring, particularly in March. The level of use of the estuary as a nursery habitat by juvenile lampreys is currently unknown. However, salinity levels measured during the site investigations for the proposed development varied from 3.1 ppt to 18 ppt across 5 samples, which is not considered suitable for juvenile lampreys.

European Eel

Unlike salmonids and lampreys, European Eel has a catadromous life history, i.e. spawning occurs at sea and juveniles migrate into fresh waters to feed and mature. The major influx of juvenile eels ("elvers") occurs in early spring. Large numbers of elvers are expected to be present at the proposed development location during this time.

European Smelt

Another species known to use the River Suir in the vicinity of the proposed development is European Smelt. This estuarine species is most likely to be present in significant numbers at the proposed development location during March and April.

7.3.4 Aquatic Environment

Water Quality

The WFD requires that each member state protects and improves water quality in all waters so that good ecological status is achieved. Additionally, proposed actions (within discrete River Basin Management Plans) are also required, to secure national natural water resources for the future. The EPA is the competent authority responsible for monitoring, protecting and improving the water environment within the Republic of Ireland. In accordance with WFD guidelines, water quality 'Status' is assigned using a variety of available data on aquatic flora and fauna (including fish), the availability of nutrients, and aspects like salinity, temperature and pollution by chemical pollutants. Morphological features, such as quantity, water flow, water depths and structures of the river beds, are also taken into account.

The original EPA water quality classification system (Quality Rating System (Q-values)) is also used to assess water quality in Irish rivers, taking into account aquatic macrophytes, phytobenthos and hydromorphology. The Quality Rating System has been shown to be a robust and sensitive measure of riverine water quality and has been linked with both chemical status and land-use pressures in catchments. Individual macroinvertebrate taxa are ranked for their sensitivity to organic pollution and the Q-value of the watercourse is based primarily on the relative abundance of these taxa within a biological sample. A review of both the Q-value status and WFD status for the watercourses was undertaken.

The online EPA Unified GIS Application provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters) or to groundwater. Table 7.10 shows the information recorded regarding water quality status within the proposed development.

Table 7.10 EPA Water Quality Results

Watercourse	Transitional Waterbody WFD Status (2010-2015)	Transitional Waterbody WFD Status (2010-2012)	Transitional Waterbody WFD Risk
Middle Suir Estuary	Poor	Moderate	At Risk
Lower Suir Estuary (Little Island - Cheekpoint)	Moderate	Moderate	At Risk
Barrow Nore Suir Estuary	Good	Moderate	Not at risk

Hydrodynamic Modelling

Hydro Environmental Ltd in association with Aquafact International Ltd was commissioned by Roughan & O'Donovan to carry out hydrodynamic modelling study of the River Suir Sustainable Transport Bridge (Hydo Environmental Ltd., 2018). The purpose of this study was to predict the potential change in flow velocities within the Suir Estuary and to assess the impact of the proposed development on bed morphology as a result of changes to the sediment transport regime.

The hydrodynamic modelling report concluded that under the proposed bridge scenario, silt is eroded and transported in suspension with the tidal flows (similar to the existing scenario) and is well mixed and distributed through-out the downstream reach forming part of the natural dynamic suspended sediment load in the estuary. The simulation indicates that the proposed bridge results in localised erosion at the structure principally away from the piles with the deposition of the eroded material occurring local to the site both upstream and downstream of the bridge. The extent of deposition from the scouring is located within 150m upstream of the bridge and 300m downstream. The scour depth at the bridge after a 24 day simulation period is 1.5m and it likely to double to 3m over time after which an armouring layer of the heavier fractions left behind will prevent further scouring of the channel at the bridge. The deposited sandy sediments are likely to slowly migrate downstream becoming more distributed spatially with distance downstream.

The hydrodynamic modelling indicates that erosion and deposition of the river bed will remain local to the bridge structure (within 150m upstream of the bridge and 300m downstream. The long-term vertical alteration to the bed elevation (3m scour depth) is less than the existing bed undulations, depths in the main channel of the Suir through Waterford City (bed elevations range from -8 to -24mOD). The potential impact is therefore rated as slight.

Plate 7.1 below illustrates the increase in flow velocities resulting from the construction and operation of the proposed development. The Hydraulic Modelling Report (Appendix 10.1) stated that the maximum flow velocity, which was calculated for the mid-ebb of an average spring tide assuming the worst-case scenario outlined above, was 1.4 m/s (depth-averaged). This is below the critical velocity for adults of all of the fish species of interest at this location. In addition, as shown in Plate 7.1 below, this flow velocity is not reached at all locations across the channel and there are areas of the channel where the maximum flow velocity will not exceed 1.1 m/s. Furthermore, flow velocities will be lower still close to the riverbed where the flow is subject to friction. Therefore, it can be concluded on the basis of best scientific knowledge that increased flow velocities resulting from the constriction of the flow by the proposed development will not impede the movements of fish, otter and other species even during peak flow conditions.

The Strategic Flood Risk Assessment (SFRA) for the North Quays SDZ included the proposed River Suir Sustainable Transport Bridge in its modelling of flood events with and without the proposed developments. The SFRA concluded the following:

"*For all simulations the impact on flood levels both locally upstream and downstream were found to be miniscule and less than the modelling tolerance of 4mm.*"

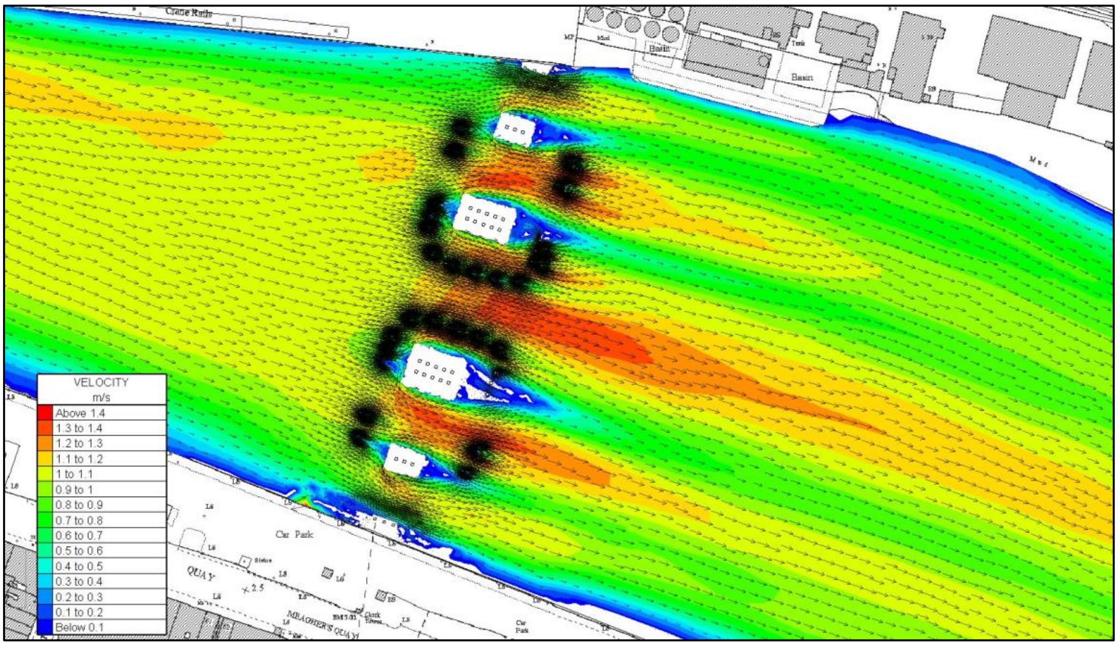

Plate 7.1 **Modelled depth-averaged flow velocities during the mid-ebb of an average spring tide for the worst-case scenario (all temporary and permanent structures in place). Source: Figure 39 of the *Hydraulic Modelling Report* (Hydro Environmental Ltd, 2018).**

Environmental Testing

The riverbed at the location of the proposed development was tested for contaminants in accordance with the EPA Guidance Document*, Code of Practice (CoP) for* Environmental *Risk Assessment for Unregulated Waste Disposal Sites* (2007). Samples were taken from exploratory holes and were tested at a Chemtest Accredited Laboratory in the UK. Further details on the contamination assessment are in Chapter 8: Soils and Geology of this EIAR.

The results of laboratory testing indicate that the samples taken from the boreholes at variable depths do not exceed the limits developed in the UK for a range of land use settings ranging from residential with home grown produce to commercial settings and public open spaces near residential or commercial areas.

Following the Waste Assessment Criteria outlined in the EPA guidance (EPA, 2007), all of the samples conform to either non-hazardous or inert. Some localised elevated levels of hydrocarbons (PAH) and heavy metals (Arsenic) were recorded, specifically in locations along the River Suir riverbed.

7.4 Field Survey Results

7.4.1 Habitats

This section describes the habitats recorded during the field survey within the study area (the proposed development footprint and a 100m buffer). Four habitats were recorded within the study area (Table 7.11). For habitat map, refer to Figure 7.2 of Volume 3 of this EIAR.

Table 7.11 Habitats Recorded Within the Study Area

Habitat Name	Fossitt Code
Tidal rivers	CW2
Lower salt marsh	CM1
Sea walls, piers & jetties	CC1
Buildings and artificial surfaces	BL3

Tidal Rivers (CW2)

The proposed development traverses the River Suir in its tidal reach. The river is designated as the Lower River Suir SAC at the location of the proposed development. This river has links to the following Annex I habitats in Ireland:

- *Estuaries* [1130]

The River Suir at this location corresponds to the Annex I habitat Estuaries. EC (2013) describes this habitat as the downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. The benthic habitat within this section of the river is classified as the level 5 biotope infralittoral fluid mobile mud in variable salinity based on the JNCC Marine Habitat Classification Scheme (Kennedy, 2008). From the GI works, salinity levels vary from 3.1ppt to 18ppt across 5 samples. The River Suir has been selected as Key Ecological Receptor of the proposed development.

Lower Salt Marsh (CM1)

One area of Lower Salt Marsh was identified on the north bank of the River Suir beside the quay wall (See Plate 7.2). This habitat is subject to more prolonged submersion by sea water and is more strongly saline than Upper Salt Marsh (CM2). The species recorded within the habitat during the walkover survey were Common Cordgrass (*Spartina anglica*), Sea Aster (*Aster tripolium*), Sea Plantain (*Plantago maritima*), Sea Arrowgrass (*Triglochin maritima*) and Sea Purselane (*Halimione portulaoides*).

This habitat has links to the following Annex I habitats in Ireland:

- *Salicornia* and other annuals colonising mud and sand [1310]
- *Spartina* swards (*Spartinion maritimae*) [1320]
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]

The dominant species, Common Cordgrass (*Spartina anglica*), is a non-native species. Therefore, this habitat does not conform to the Annex I habitat *Spartina* swards [1320], or any other Annex I habitat (McCorry, 2006). This habitat is outside the footprint of the proposed development and will not be impacted.

Plate 7.2 Lower Salt Marsh habitat on the north bank of the River Suir

Sea Walls, Piers and Jetties (CC1)

This category is used for all coastal constructions that are partially or totally inundated by sea water at high tide. This habitat was recorded along the South Quay as a series of floating jetties where many boats, barges and cruisers are moored.

Buildings and Artificial Surfaces (BL3)

The North Quay consists of wharves made up of reinforced concrete beam and slabs on reinforced concrete columns. Further away from the river, the majority of the surrounding area comprises built areas including the urban centre of Waterford. Generally built habitats are not considered of high ecological significance.

Character of Habitats

The site of the proposed development has been highly modified from its natural state over centuries of urbanisation and navigation. It is urban in its character.

Significance of Habitats

The habitats present on the site were assessed in accordance with best practice guidance (TII, 2009). The River Suir itself, although highly modified, is the habitat with the highest biodiversity value within the site. The river at the location of the bridge corresponds to the Annex I habitat Estuaries. Furthermore, the river is regarded as being a receptor of International Importance on the basis of its designation as a SAC.

7.4.2 Fauna

Terrestrial Mammals

Badger

No evidence of badger was recorded in the study area and there is limited suitable habitat in the area. Therefore, badger have not been included as a Key Ecological Receptor.

Otter

During the dedicated Otter survey, signs of Otter activity were recorded within the study area. Evidence of Otter activity included spraints and prints beneath the North Quay wall (See Plate 7.3). No potential holts or couches were recorded within the derogation limit (150 m) of works. Beneath the quay wall does provide important cover for Otter. The site also provides a potential commuting link to areas of more suitable habitat up and downstream. The alteration of the North Quay wall has the potential to increase barriers of connectivity for Otter commuting within the Lower River Suir SAC. This species is likely to be impacted by the proposed development and has been included among the Key Ecological Receptors of the proposed development.

Plate 7.3 Otter prints beside North Quay Wall

Bats

All nine resident breeding Bat species in Ireland are legally protected and roost sites (whether in use or not) are also protected under both European and Irish legislation. All Bat species occurring in Ireland are listed on Schedule V of the Wildlife Acts as protected species.

The Bat suitability assessment conducted during the walkover survey did not identify any potential roosts within the study area.

A Bat activity survey, to supplement the previous studies (Kelleher, 2014; Harrington, 2017) was undertaken within the study area. The survey was carried out on the 24th July 2018 in suitable weather conditions. Details of the survey are presented in Table 7.12 below.

Table 7.12 Bat Survey Details

Date	Start Time	End Time	Temperature	Wind and Rain
24th July 2018	22:05	00:15	15°C	Gentle breeze and dry

Bat activity during the survey was low. Two species of Bat, namely Common Pipistrelle (*Pipistrellus pipistrellus*) and Leisler's Bat (*Nyctalus leisleri*), were recorded during the survey. Table 7.13 below shows the number of calls recorded for each species.

Table 7.13 Bat Survey Results

Date	No. calls recorded
Common Pipistrelle	4
Leisler's Bat	3

Bats could be negatively impacted by poorly-designed or excessive artificial lighting during the construction and operation of the proposed development. Therefore, bats have been included as a Key Ecological Receptor of the proposed development.

Marine Mammals

No sightings or evidence of any marine mammals were recorded during the multidisciplinary survey. The Marine Mammal Risk Assessment is presented in Appendix 7.1. On the basis of the conclusions of the Marine Mammal Risk Assessment, marine mammals are not considered further in this report.

Other Mammal Species

Development projects will generally not involve significant impacts on populations of other highly mobile protected mammal species, nor are there particularly relevant/effective mitigation measures specific to any of these species. Thus, in most cases, further surveys of e.g. Badger or Hedgehog, over and above the field evidence collected during the multidisciplinary walkover survey would not be appropriate.

Birds

The habitat assessment undertaken as part of the multidisciplinary walkover survey did not identify habitats that support important assemblages or significant populations of breeding or wintering birds. There is no Kingfisher (*Alcedo atthis*) nesting habitat in the study area and Kingfisher movement will not be restricted. Table 7.14 lists the birds that were recorded during the multidisciplinary walkover surveys in June 2018.

Table 7.14 Bird species recorded during the surveys.

Common Name	Latin Name
Black-headed Gull	*Chroicocephalus ridibundus*
Hooded Crow	*Corvus cornix*

Common Name	Latin Name
Peregrine Falcon	*Falco peregrinus*

Reptiles and Amphibians

The multidisciplinary walkover surveys did not record any evidence of Common Frog (*Rana temporaria*), Smooth Newt (*Lissotriton vulgaris*) or Common Lizard (*Zootoca vivipara*) within the study area. Further survey/assessment was not deemed necessary and they have not been included as a Key Ecological Receptors for the proposed development.

7.4.3 Flora

Records of plants protected under the Irish Flora Protection Order (2015), from with the Zone of Influence include Borrer's Saltmarsh-grass (*Puccinellia fasciculata*), Meadow Barley (*Hordeum secalinum*) and Divided Sedge (*Carex divisa*).

No flora listed on the Flora Protection Order 2015 were recorded within the study area. Table 7.15 below provides a list of plant species recorded during the field survey in June 2018.

Table 7.15 Plant species recorded during the surveys.

Common Name	Latin Name
Annual Seablite	*Suaeda maritima*
Bramble	*Rubus fruticosus agg.*
Butterfly Bush	*Buddleja davidii*
Common Cord-grass	*Spartina anglica*
Ivy	*Hedera helix*
Ribwort Plantain	*Plantago lancelota*
Sea Arrowgrass	*Triglochin maritima*
Sea Aster	*Tripolium pannonicum*
Sea Plantain	*Plantago maritima*
Sea Purslane	*Halimione portulaoides*
Traveller's Joy	*Clematis vitalba*
Twiggy Mullein	*Verbascum virgatum*
Yorkshire Fog	*Holcus lanatus*

7.4.4 Invasive Alien Species

One species, Common Cordgrass (*Spartina anglica*), subject to restrictions as listed on the Third Schedule of the Birds and Natural Habitats Regulations was recorded on the bank of the River Suir within the study area. A number of examples of other unlisted but invasive species, including Butterfly Bush (*Buddleja davidii*) and Traveller's Joy (*Clematis vitalba*), were recorded within the study area. There is a risk of contamination to other sites from the Chinese mitten crab (*Eriocheir sinensis*) which has occurred in the Waterford Estuary since 2005. Invasive species pose a threat to biodiversity in the area and have been included as a Key Ecological Receptor.

7.4.5 Ecological Corridors

Article 10 of the Habitats Directive recognises the importance of ecological networks as corridors and stepping stones for wildlife, including for migration, dispersal and genetic exchange of species of flora and fauna. The Directive requires that ecological connectivity and areas of ecological value outside the Natura 2000 network of designated ecological sites are maintained and it recognises the need for the management of these areas through land use planning and development policies.

Ecological corridors are important in connecting areas of local biodiversity with each other and with nearby designated sites to prevent islands of habitat from becoming isolated. Ecological corridors include linear features such as treelines, hedgerows, disused railway lines, rivers, streams, canals and ditches stepping stones for wildlife moving within their range. They are particularly important for mammals, especially bats, and small birds. The River Suir is important ecological corridor and provides a range of habitats and facilitate networks or linkages to the surrounding countryside for biodiversity, flora and fauna. The River Suir has been selected as a Key Ecological Receptor of the proposed development.

7.5 Key Ecological Receptors

This section of the report provides details of the Key Ecological Receptors that were identified during the desk study and the subsequent field surveys. The desk study provided information on designated sites of conservation interest in relation to the proposed development. This included an assessment of European Sites with the potential to be impacted by the proposed development and also a study of sites that are designated under national legislation (NHAs). Proposed Natural Heritage Areas (pNHAs) were also considered within the study area.

7.5.1 KERs Identified During Desk Studies and Field Surveys

The KERs identified are described in greater detail in Table 7.16 together with an ecological valuation for each.

Table 7.16 Key Ecological Receptors Identified During Desk Studies and Field Surveys

KER	Description	Importance/Ecological Valuation (TII, 2009)
KER 1 River Suir	The proposed development traverses the River Suir. This watercourse forms an integral part of the Lower River Suir SAC. The Qualifying Interests of this SAC include habitats and species likely to be impacted upon by the proposed development, such as Atlantic Salmon and Otter. The River Suir at the location of the proposed development corresponds to the Annex 1 habitat 'Estuaries'. The river channel will be permanently altered by the proposed development. Therefore, the River Suir has been included as a Key Ecological Receptor.	**International Importance** on the basis that this watercourse forms an integral part of the Lower River Suir SAC and supports habitats and species listed on Annexes I and II of the Habitats Directive.
KER 2 Migratory Fish	Twaite Shad, Atlantic Salmon and Lamprey species are all Qualifying Interests for the Lower River Suir SAC. These species require unimpeded passage upstream in the River Suir to spawn. European Eel also require unimpeded passage from sea to freshwater habitats in the River Suir. Fish could be impacted by reduced water quality as a result of accidental pollution events. Therefore, migratory fish have been included as a Key Ecological Receptor.	**International Importance** on the basis that species is listed on Annex II and IV of the Habitats Directive and protected under the Wildlife Acts migrate through the study area.
KER 3 Otter	Otter is a Qualifying Interest of both the Lower River Suir SAC and the River Barrow and River Nore SAC. Otter spraints and prints were identified along the bank of the River Suir within the study area. Otter are protected wherever they occur and are likely to use the river bank for commuting. Otter has therefore been selected as a Key Ecological Receptor.	**International Importance** on the basis that this species is listed on Annex II and IV of the Habitats Directive and protected under the Wildlife Acts is present within the study area.
KER 4 Bats	Bats are protected wherever they occur. Two Bat species, Common Pipistrelle and Leisler's Bat, were recorded within the study area during the activity survey. Bats could be negatively impacted by poorly-designed or excessive artificial lighting during the construction and operation of the proposed development and have therefore been selected as a Key Ecological Receptor.	**Local Importance (Higher Value)** on the basis that these species is listed on Annex IV of the Habitats Directive and protected under the Wildlife Acts are present within the study area, however not occurring in county or nationally important numbers.
KER 5 Invasive Alien Species (IAS)	Common Cordgrass was identified on the bank of the River Suir adjacent to the proposed development. Chinese Mitten Crab has been recorded within Waterford Harbour. IAS are present within the study area and could potentially be spread further by the proposed development. IAS have therefore been selected as a Key Ecological Receptor.	IAS have the potential to impact negatively on native species diversity and structures. There is a risk of spread of IAS associated with the proposed development.

7.6 Description of Likely Impacts (Unmitigated)

7.6.1 Impacts on Designated Areas

The River Suir Sustainable Transport Bridge traverses one European designated site for nature conservation (European site), namely the Lower River Suir SAC and is hydrologically connected to the River Barrow and River Nore SAC. There are no other European sites occur within the Zone of Influence of the proposed development.

As likely significant effects on the Lower River Suir SAC and the River Barrow and River Nore SAC could not be excluded at the screening stage, an Appropriate Assessment (AA) was deemed necessary and a Natura Impact Statement (NIS) was prepared. The NIS presents all the predicted impacts on the sites and their Qualifying Interests. The NIS also provides a detailed analysis and evaluation of these impacts in the context of the Conservation Objectives. The NIS prescribes mitigation to eliminate adverse effects on the integrity of the SACs.

7.6.2 General Impacts on Key Ecological Receptors

General impacts on biodiversity that are typical of development are described in this section. These potential negative effects are considered with reference to the previously defined Key Ecological Receptors.

Direct Habitat Loss

The proposed development will result in the complete loss of aquatic habitat within the River Suir. The River Suir has been identified as a Key Ecological Receptor and potential impacts on the watercourse are discussed in Section 7.6.3 below. The proposed South Plaza will be located on existing Building and Artificial Surfaces (BL3) habitat and will involve no change in habitat.

Habitat Fragmentation

The construction and operation of the piers and cofferdams within the River Suir represents a partial obstruction of the channel. This will reduce the cross-sectional area open for passage by fish, constrict the flow of water and thereby increase flow velocities. This could potentially inhibit the migration of fish upstream, preventing adults reaching spawning habitats, and downstream, preventing juveniles from reaching the sea.

The proposed development may also create barriers to connectivity for Otter. The proposed development could potentially inhibit the movement of bats as the bridge may block commuting routes between areas of foraging habitat and roosts.

Water Quality Impacts

<u>Construction Phase Impacts</u>

Construction activities within and adjacent to surface waters, e.g. rivers, can negatively impact water quality. In the case of the proposed River Suir Sustainable Transport Bridge, the construction of the proposed development, if not properly managed, has the potential to impact on water quality as follows:

- Sedimentation – In the absence of appropriate mitigation, the construction of the proposed development provides for sedimentation impacts as follows:
    - During the erection or removal of the cofferdams within which the bridge piers will be constructed and during the driving of piles for the abutments and collision protection system, the estuarine silts on the riverbed will be disturbed, causing sediment to become suspended in the water column.

However, given the naturally high sediment load in the River Suir in the vicinity of the proposed development, this will not lead to significant impacts.

- The presence of the cofferdams and piles will give rise to scouring of silt from the riverbed (Hydro Environmental Ltd, 2018). However, ecological effects of suspended sediments resulting from this level of scouring will be imperceptible.
- Surface water run-off from adjacent construction areas is likely to contain high levels of suspended sediments (and contaminants). Such run-off, if not attenuated and treated prior to discharge to the River Suir, has the potential to cause significant ecological impacts. High deposition can lead to smothering of the habitat, which may alter the vegetation composition; notably, this may increase the occurrence of the negative indicator species Common Cord-grass (*Spartina anglica*). Deposition of fine sediments can also increase the amounts and persistence of chemical contaminants in the receiving habitat, leading to further changes in the vegetation structure and composition.
- Suspended sediments can also exacerbate other water quality impacts by providing chemical contaminants with a surface on which to bind, thereby increasing the bioavailability of these contaminants, eventually leading to ecological effects.

- Spillage of cementitious materials – During bridge construction, particularly when pouring concrete for the support piles and abutment of the northern abutment, concrete or other cementitious materials may spill directly into the River Suir or be washed into the river in construction site run-off. Cementitious materials are highly alkaline and, consequently, can drastically alter the pH of the receiving watercourse. This can lead to profound ecological impacts on the affected watercourse and any habitats connected to it. Changes in the alkalinity of surface waters can affect the pH of connected ground waters and soils. This can affect the vegetation composition by causing damage to pH-sensitive species. As the pH impact is greater near the affected watercourse, vegetation here is disproportionately affected, leading to changes in zonation.
- Spillage of hydrocarbons – Vehicles, plant and equipment which will be used during the construction of the bridge rely on hydrocarbons such as diesel, petrol and lubricating oils. Leaks from poorly maintained vehicles, plant, equipment or storage tanks provide for a risk of input of hydrocarbons into the environment. In the absence of appropriate mitigation, hydrocarbons from the construction site may spill directly into the River Suir or be washed into the river in construction site run-off. This has the potential to cause negative ecological impacts on the River Suir and any habitats connected to it. Hydrocarbons can have direct phytotoxic effects, including reducing the ability of plants to absorb water and nutrients from their environment. These compounds can also alter the nutrient balance and microbiota in soil and water, which can benefit some plant species while detrimentally affecting others. Such changes have the potential to alter the vegetation structure and composition of the habitat.
- Painting – Most commonly used paints are not toxic to marine ecosystems and, therefore, do not pose a risk to water quality, particularly in the relatively small quantities that will be used. However, there is a significant risk to water quality if the paints used contain organotin compounds, e.g. tributyltin (TBT), which are used as anti-fouling agents and are known to have detrimental effects on the endocrine function of animals, including causing imposex in marine molluscs.

- Cutting of cofferdams – Sections of the sheet piling used to form the temporary cofferdams will have to be cut using an abbrasive water jetting (high-pressure stream of fresh water with "garnet", i.e. an inert abbrasive mineral additive). This system requires a maximum of 20,000 litres of potable water per shift. Thus, the rate of injection of fresh water will be < 0.05% of the discharge of the River Suir (50^{th} percentile discharge over the full length of the river taken as 4.8 m3/s) and, therefore, any effect on salinity will be imperceptible against the background (natural) variation at this location. Any effect of the garnet additive will be of a small magnitude owing to the tiny amounts used and will be very localised (only perceptible within 5-10m of the cuttling locations. Any effects on benthic habitats and species will be fully reversible within one year, in the absence of any mitigation.
- Resuspension of contaminants bound in the sediment – Chapter 9 (Hydrology) of the EIAR states that there are "[some] *localised elevated levels of hydrocarbons (PAH) and heavy metals (Arsenic) were recorded, specifically in locations along the River Suir riverbed*". Piling and scour during the construction stage has the potential to cause temporary resuspension and, consequently, bioavailability of these compounds. However, owing to the low concentrations present, any effect on water quality will be of low magnitude and localised to within c. 300m of the proposed development. Any effects on benthic communities will be fully reversible within one year, in the absence of any mitigation.
- Faecal contamination – Inadequate treatment of wastewater from on-site toilets and washing facilities also provides for potential water quality impacts which could lead to ecological effects in the River Suir and any habitats connected to it. Faecal contamination can alter the nutrient balance in soils and water, causing significant changes in microbial communities and reductions in oxygen levels. This can have significant effects on vegetation structure and composition in receiving habitats.

<u>Operational phase impacts</u>

The south quays plaza and the southern half of the bridge will drain to the existing surface water drainage system. This is treated at the Waterford City Water Treatment Plant before discharge to the River Suir. Prior to the development of the North Quays SDZ, the northern half of the bridge will drain to the River Suir as per the existing situation. However, the bridge will not be in use prior to the development of the North Quays SDZ. Consequently, there will be no deposition of pollutants occurring and, therefore, any impact will be imperceptible.

Once the North Quays SDZ is developed, the northern section of the bridge will discharge to the new North Quays surface water drainage network. In addition, the bridge traffic is limited to pedestrians and an electric shuttle bus and it is not anticipated that any chemicals or hydrocarbons will be transported across the bridge. Thus, the risk of spillage is considered to be extremely low. Salting and gritting of trafficked surfaces during icy conditions will result in increased salinity, pH, conductivity and total-dissolved-solids concentrations in the run-off from the bridge. However, it is anticipated that the use of salt and grit will be minimal due to the light trafficking of the bridge. The new North Quays drainage network will incorporate pollution controls, including silt traps, petrol interceptors and sustainable urban drainage systems (SUDS) features treating all run-off prior to discharge to the River Suir.

The permanent presence of the bridge abutments and support piles and the piles for the vessel collision protection system provide for hydraulic effects such as increased flow velocities leading to scour of the riverbed, which will cause the suspension of fine sediments in the water column. However, this will occur at a lower magnitude than during the worst-case scenario considered for the construction stage and, therefore, there will be no significant water quality effect in this regard.

The bridge will require repainting during its life cycle. As discussed for the construction stage, while most paints do not pose a risk to water quality, paints containing organotin compounds such as TBT do provide for significant water quality impacts.

The opening mechanism for the bridge will be by use of hydraulic rams. The use of hydraulic rams poses a risk that hydraulic fluid may enter the River Suir in the event of a leak. However, the probability of such a leak occurring is very low and the amounts of any oil that might enter the river are also very low. Therefore, this would result in a localised, temporary, slight to imperceptible impact on water quality. Therefore, the risk to water quality from the use of hydraulic rams is negligible.

Displacement/Disturbance of Fauna

The construction of the bridge piers, the deck and landing areas, as well as finishing of the bridge provide for noise and vibration impacts which could cause disturbance to both aquatic and terrestrial species.

Excessive artificial lighting of the construction area also presents the risk of light disturbance for both aquatic and terrestrial species. Prolonged or repetitive disturbances have the potential to cause barriers to connectivity for species moving upstream and downstream past the construction area.

Dispersal of Invasive Alien Species

Barges or other vessels used during the construction of the proposed development have the potential to spread certain aquatic invasive species, particularly Chinese Mitten Crab, within the Suir Estuary and, potentially, the Rivers Barrow and Nore. This could lead to significant detrimental impacts on sensitive marine habitats and species. In the absence of control measures, there is a possibility that species including Common Cordgrass may be inadvertently spread during construction through the movement of equipment and contaminated soil to, from or within the site. Invasive Alien Species have been included as a Key Ecological Receptor.

7.6.3 Impacts on Key Ecological Receptors

Impacts on the key ecological receptors as defined in the preceding sections are described in Table 7.17.

Table 7.17 Impact Characterisation for Key Ecological Receptors Based on EPA (2002) and TII (2009)

Key Ecological Receptor	Construction Phase Impacts	Operational Phase Impacts	Ecological Significance if Unmitigated
KER 1 River Suir	Direct impacts of the proposed works on this Key Ecological Receptor potentially include the following: Permanent loss of aquatic habitat within the footprint of the bridge piers and vessel collision system. Habitat fragmentation and barrier effect may occur if Otter and aquatic species are not able to migrate along the watercourse during the construction of the bridge. This impact could also affect birds and bats that may use this section of river. Accidental pollution events may result in sediment and pollutants entering the river and affecting water quality during the construction phase. Temporary disturbance to aquatic species during in-stream piling and pier construction. Habitat degradation due to artificial lighting of the construction area during hours of darkness.	Inappropriate lighting of the bridge during its operation has the potential to impact aquatic species.	The direct loss of habitat associated with the River Suir Sustainable Transport Bridge is not considered to be significant as it involves only the degradation and habitat loss of a very small area (9519 m^2) of the receptor. This is considered to constitute a **Permanent Slight Negative Impact** over a very small area of a receptor of International Importance. The impact will alter the character of the environment in this area but will not affect its sensitivities. The potential for habitat fragmentation and barrier effects is considered to constitute a **Permanent Slight-Moderate Negative Impact** as it applies to the sensitive species such as Otter that are likely to use the watercourse for commuting to wider areas within their ranges. The risk of pollution of the river during the construction phase is considered to constitute a **Potential Temporary Significant Negative Impact** as, if it were to occur, it would have the potential to impact sensitive receptors such as Atlantic Salmon and Twaite Shad over a short period of time and over a far wider area than the site itself.

Key Ecological Receptor	Construction Phase Impacts	Operational Phase Impacts	Ecological Significance if Unmitigated
KER 2 Migratory Fish	Direct impacts to fish at the construction phase include habitat fragmentation and barrier effect. The presence of structures within the River Suir represents a partial obstruction of the channel. This reduces the cross-sectional area open for passage by fish and constricts the flow of water, thereby increasing flow velocities. The partial obstruction and higher flow velocities have the potential to form a barrier to migratory fish species. Other effective barriers to fish migration may arise from acoustic or lighting impacts as described below. Temporary disturbance due to noise and vibration during in-stream piling operations, including the driving of the support piles for the bridge piers and abutments and, to a lesser extent, the sheet piles for the new south quay wall and temporary cofferdams. Temporary disturbance due to inappropriate lighting during construction can form a barrier to connectivity for nocturnal fish species. Specifically, light spill onto the water during hours of darkness may cause migrating fish to avoid the area in the vicinity of the bridge, effectively preventing these species from moving past the construction area. Fish may be impacted indirectly by a deterioration in water quality during the construction phase caused by run-off of sediment and/or pollutants entering the river.	Habitat fragmentation and barrier effect are potential ongoing direct impacts during the operational phase of the proposed development. Inappropriate lighting designs or regimes can cause disturbance to or form a barrier to connectivity for nocturnal fish species. The operation of the proposed development does not provide for any noise or vibration impacts which would be perceptible by fish species.	The potential for habitat fragmentation and barrier effect is considered to constitute a **Permanent Slight-Moderate Negative Impact** as it applies to the migratory fish that commute upstream. The risk of pollution of the river during the construction phase is considered to constitute a **Potential Temporary Significant Negative Impact** as, if it were to occur, it would have the potential to impact sensitive receptors such as Atlantic Salmon and Twaite Shad over a short period of time and over a far wider area than the site itself. Significant impacts on Migratory Fish are not anticipated at the International, National or County Level.
KER 3 Otter	While no Otter holts were recorded in the study area, it is likely that there are breeding holts located in the wider area as Otter is known to occur in the area. During the surveys carried out to inform this assessment, spraints and prints beneath the North Quay wall indicated	Habitat fragmentation and barrier effect are potential ongoing direct impacts during the operational phase of the proposed development.	No significant direct impacts are anticipated on this species given the nature of the habitats and given that no breeding or resting places were recorded at the proposed crossing point.

Key Ecological Receptor	Construction Phase Impacts	Operational Phase Impacts	Ecological Significance if Unmitigated
	that Otter use the intertidal habitats in the vicinity of the proposed development. Otters may use this habitat for foraging or as a commuting link. The proposed development has the potential to form a barrier to connectivity between different areas of Otter habitat by creating a physical obstruction to Otter movements i.e. by emitting noise and light such as to deter Otter from passing the proposed development area. Both noise/vibration and light arising from construction activities, especially pile driving and floodlighting, have the potential to cause disturbance to Otter, leading to reduced connectivity between areas upstream and downstream of the proposed development for the duration of the construction phase. Impact from pollution directly or indirectly as a result of reduced prey availability are unlikely to be significant as a result of the proposed scheme as this is not anticipated due to strict environmental controls. Impacts to fish species during construction have the potential to reduce the total biomass available to Otter as food.	Inappropriate lighting of the bridge during its operation does have the potential to deter Otter from moving past the bridge. Accidental pollution events may result in sediment and pollutants entering the river and affecting water quality during the operational phase.	The potential for habitat fragmentation and barrier effects is considered to constitute a **Permanent Slight-Moderate Negative Impact** at the local scale as it applies to the sensitive species such as Otter that are likely to use the watercourse for commuting to wider areas within their ranges. It is considered that impacts could be reversible through appropriate design and mitigation. The potential for pollution of watercourses during the construction phase is considered to constitute a potential **Short-term Moderate-Significant Negative Impact** as it has the potential to alter a sensitive receptor over a short period of time and over a far wider area than the site itself. It is considered that impacts could be reversible through appropriate design and mitigation. The potential for pollution of watercourses during the operational phase is considered to constitute a potential **Long-term Slight Negative Impact** as it has the potential to alter a sensitive receptor over a long period of time and over a far wider area than the site itself. It is considered that impacts could be reversible through appropriate design and mitigation. Significant impacts on Otter are not anticipated at the National or County Level.

Key Ecological Receptor	Construction Phase Impacts	Operational Phase Impacts	Ecological Significance if Unmitigated
KER 4 Bats	Direct impact on bats during construction are likely to include displacement from the area during the construction phase through general construction activities, noise and lighting.	Habitat fragmentation, barrier effects and habitat deterioration due to presence of artificial lighting are potential ongoing direct impacts during the operational phase.	It is considered that indirect impacts on bats are likely to be **Long-term Slight Negative Impacts** resulting from loss of foraging habitat along the river channel. The habitat loss associated with the proposed development is considered to be minor given the low levels of bat activity recorded in the area of the proposed development and the ambient noise and artificial light levels in Waterford City. It is considered that during the operational phase there is the potential for **Permanent Moderate Negative Impacts** on a resource of **Local Importance (Higher Value)** associated with the displacement of Bats away from the area of the bridge. Significant impacts on Bats are not anticipated at the National or County Level.
KER 5 Invasive Alien Species (IAS)	Common Cordgrass was found at one location within the study area of the proposed development, i.e. adjacent to the north quay wall. Chinese Mitten Crab has been recorded within Waterford Harbour. IAS may be inadvertently spread during construction through the movement of machinery within and outside the site e.g. the jack-up barge, poses a risk that invasive species such as Chinese Mitten Crab could be spread within the Suir-Barrow-Nore Estuary.	The operation of the River Suir Sustainable Transport Bridge is considered unlikely to facilitate the spread of IAS.	Construction of the development may lead to the spread of IAS.

7.7 Mitigation

This section describes the measures that are in place to mitigate any harmful or negative impacts associated with the proposed development and the identified Key Ecological Receptors as described in the preceding sections. General mitigation measures included within the design of the proposed development are described first, with more specific measures to prevent or minimise impacts on the individual receptors provided subsequently.

7.7.1 General Mitigation

Mitigation by Avoidance

The proposed development minimises passage through ecologically sensitive areas and has been constraints-led from the initial phase, through an iterative design process; and, into the final proposed development. The bridge design has followed the basic principles outlined below to eliminate the potential for ecological impacts on Key Ecological Receptors where possible and to minimise such impacts where total elimination is not possible. The proposed development has been selected to avoid, as far as possible, direct, in-direct or secondary adverse impacts on European sites or other designated sites for nature conservation. It is not possible to avoid crossing the Lower River Suir SAC. The proposed development has been designed to minimise direct or indirect impacts on any habitats or species or other ecological features that were classified as being of Local Importance (Higher Value) or above.

Mitigation by Design

The proposed development has been developed having regard to European and National legislation and all relevant TII guidelines and engineering best practice for the planning and construction of development projects. These guidelines and best practice provide practical measures that can be incorporated into the design to minimise the impact and protect the receiving environment. The following is an overview of the design measures that will be employed to minimise and avoid significant impacts on the ecological receptors within the Zone of Influence.

- The land acquisition boundary associated with the proposed development will be fenced off at the outset of the construction phase of the proposed development and will avoid the potential for loss of habitat outside of the construction footprint.
- The bridge has been designed to minimise the potential for both short and long term negative ecological impacts on all watercourses. The lighting design will incorporate measures to minimise light spillage and disturbance to nocturnal species.
- The bridge drainage has been designed to provide a high level of attenuation and water quality controls, as described in detail Chapter 10: Hydrology.

7.7.2 Specific Mitigation Measures

KER 1 - River Suir

<u>Habitat Loss</u>

The construction of the proposed development will result in the loss of permanent loss of Tidal River habitat at the location of the bridge piers and vessel protection system. The loss of this habitat cannot be mitigated for. The proposed development will not reduce the ability or potential for the fisheries and aquatic habitat to maintain fish stocks or the food of fish. The proposed development will not result in loss of suitable spawning habitat for any fish species.

Water Quality

Construction Phase

The following mitigation measures relating to the protection of water quality shall apply during the construction of the Project:

Sedimentation and surface water run-off

- In order to attenuate flows and minimise sediment input into the River Suir from site run-off, all surface water run-off from the construction site shall be directed to a temporary attenuation facility, where the flow rate will be attenuated and sediment allowed to settle out, before passing through a hydrocarbon interceptor and being discharged to the existing South Quays sewer network.
- Sheet piling or combi-wall piling for the new quay wall either side of the southern bridge abutment shall be installed prior to excavation on the south quays and demolition of the existing reinforced earth wall. This will form an effective barrier to run-off from the south quays during construction.
- The removal of cofferdams and temporary support piles will be undertaken at or near high water to maximise the dilution factor for any disturbed sediments and minimise the time during which any contaminants bound to disturbed sediment is suspended in the water column.
- Owing to the nature and scale of the Project, there will be minimal stockpiling of materials on site. However, any material stockpiled shall be located as far from the riverbank as practicable, covered and remain stockpiled for as short a time as possible.
- The Contractor shall provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour and the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk of input of sediment or construction materials into the river during flood events.
- Prior to the Construction Environmental Management Plan being accepted and implemented, it shall be submitted to both the NPWS and IFI to ensure that all requirements of those bodies are satisfied.

Cementitious materials

- The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of any input of cementitious material into the River Suir from the landside elements of the construction.
- In addition, all shuttering shall be securely installed and inspected for leaks prior to cement being poured and all pouring operations shall be supervised monitored for spills and leaks at all times.
- In order to eliminate any remaining risk of input of cementitious material into the River Suir from the landside elements of the construction, all pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather.
- In order to prevent input of cementitious materials into the River Suir from the in-stream elements of the construction, concrete structural elements shall be pre-cast, wherever possible.
- In addition, at all locations where concrete or other wet materials are to be used, bunded steel decks will be used to capture any spilled concrete, alkaline water displaced from inside tubular steel piles or spilled sealants or other materials.

- Any such materials collected on these platforms shall be transferred to the landside construction areas and disposed of in accordance with the Construction and Demolition Waste Management Plan.

Hydrocarbons and other chemicals

- The measures prescribed with regard to surface water run-off will also minimise the risk of any input of hydrocarbons and other chemicals into the River Suir from the landside elements of the construction. However, the following additional measures shall also apply.
- Vehicles and plant shall be refuelled off-site where possible and all fuelling of machinery shall be undertaken at least 30m from the River Suir.
- All fuelling of vessels shall be undertaken on an impervious base in bunded areas and all fuelling equipment shall be regularly inspected and serviced.
- Standing plant and machinery shall be placed on drip-trays.
- All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. shall be stored in the construction site compound, on an impervious base which shall be bunded to 110% capacity and appropriately secured.
- All plant and construction vehicles shall be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery.
- Spill kits shall be available on site during construction, including on the jack-up barge during pile driving.

Painting of the bridge

- Paints containing organotin compounds, e.g. TBT, shall not be permitted for use.
- In order to minimise the risk of paint spillage into the River Suir, the majority of the bridge deck shall be painted over land, i.e. prior to be lifted into position over the river, and painting of the remaining sections (mostly at joining points) shall be carried out above bunded steel decks which will capture any spilled paint.

Any construction-phase water quality impacts remaining following the inclusion of the above mitigation are considered to be slight to imperceptible and the risk of such impacts occurring is negligible. Therefore, given the full and proper implementation of these mitigation measures, the construction of the Project will not give rise to any adverse effects on the Conservation Objectives of either the Lower River Suir SAC or the River Barrow and River Nore SAC.

Operational Phase

As discussed in Section 4.2.1, the south quays plaza and southern half of the bridge will drain to the existing surface water drainage system, which provides adequate treatment before discharge to the River Suir and which has capacity to receive the bridge drainage, and the northern half of the bridge will drain to the River Suir as per the existing situation, but will not be in use prior to the development of the North Quays SDZ, after which it will drain into the new North Quays surface water drainage network, which will incorporate pollution controls and SUDS features treating all run-off prior to discharge. Furthermore, the use and regular maintenance of the bridge also pose almost no risk to water quality. Therefore, any water quality impacts from the day-to-day operation of the bridge will be slight to imperceptible and no mitigation is required.

The only element of the operation/maintenance of the Project with the potential to give rise to significant water quality impacts is repainting of the bridge. In order to avoid such impacts, the following mitigation shall apply:

- Paints containing organotin compounds, e.g. TBT, shall not be permitted for use.
- In order to minimise the risk of paint spillage into the River Suir, a platform shall be provided to form an effective barrier between the repainting works and the River Suir, capturing any spilled paint or other chemical.

Given the full and proper implementation of these water quality protection measures, the operation and maintenance of the Project will not give rise to any impacts on the River Suir.

Lighting and Shade

Light spill onto the river channel during hours of darkness has the potential to form a barrier to the migration of nocturnal species and to encourage night-time activity of diurnal species, causing them to become more vulnerable to nocturnal predators. Owing to the scale of the proposed development, it will not result in significant shading impacts.

Turning off construction lighting over the river outside of working hours will eliminate any risk of these impacts outside of those hours. This will eliminate the risk of such impacts occurring during the months of April to September, inclusive, and restrict such impacts to before 7:00 pm and after 7:00 am on weekdays and before 4:30 pm and after 8:00 am on Saturdays during the months of October to March, inclusive. This would ensure at least 12 hours free of artificial light every night of the year and more at weekends. The remaining level of artificial lighting is considered unlikely to result in the significant effects discussed above. However, the risk of such effects occurring can be minimised further by ensuring that construction lighting is limited to the minimum area required, thereby minimising any light spill onto the river channel.

Therefore, subject to any Health & Safety and navigational requirements, construction lighting over the river channel shall be turned off outside of working hours. In addition, construction lighting will be limited to the minimum area required to be lit and minimise light spill onto the river channel. The Ecological Clerk of Works will ensure that these measures are adhered to during the construction stage.

During the operational phase, lighting should be limited to the minimum area required to be lit and there should be no light spill onto the river channel.

Owing to the scale of the proposed development, neither its construction nor its operation has the potential to give rise to significant shading impacts on the River Suir.

KER 2 - Migratory Fish

Mitigation measures prescribed for Migratory Fish below are relevant for nocturnal and diurnal fish species, fish of small body size and hearing specialists (fish with highly specialised auditory sense). The rational for this mitigation is fully detailed in the NIS for the proposed development (ROD, 2018).

<u>Noise and Vibration</u>

The following are the mitigation measures which will apply to pile driving:

- All pile driving shall be restricted to the following periods:
    - 1st June to 31st August, inclusive; and,
    - 1st November to 31st January, inclusive.
- All pile driving shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays.

- All pile driving shall be restricted to between 8:00 am and 6:00 pm.
- All breaks between pile drives shall be of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, all such breaks shall be concurrent.
- A 30-minute soft-start/ramp-up procedure shall apply to each pile drive.
- If, for any reason, a derogation from any of the above is required, this shall only be permitted with the consent of WCCC, the NPWS and IFI.
- All of the above shall be supervised by an Ecological Clerk of Works.

Lighting and Shade

The mitigation prescribed for impacts of artificial lighting (above) are considered more than adequate to eliminate any risk of significant such impacts on Migratory Fish during the construction and operation of the proposed development.

Owing to the scale of the proposed development, neither its construction nor its operation has the potential to give rise to significant shading impacts on the River Suir and the migratory fish species present.

Water quality

Given the full and proper implementation of the water quality protection measures, described above, the operation and maintenance of the proposed development will not give rise to any adverse effects on Migratory Fish through a deterioration of water quality.

KER 3 – Otter

Barrier effect

The welfare of Otter will be ensured primarily through the provision of continued safe access for Otter upstream and downstream of the development. Adequate provision for Otter at the bridge crossing is required to allow the species to retain continued access throughout the River Suir. The design of the bridge includes a gap between the most south abutment and the quay wall. This will allow the continued connectivity both for intertidal mudflats and for Otter at the south bank of the River Suir. Spanning large watercourses typically results in limited disruption to Otter activity (TII, 2008c). When the bridge is in operation, Otter will still be able to pass along the shoreline and will adapt quickly to the presence of traffic above.

Noise and Vibration

The mitigation prescribed for noise and vibration impacts (above) are considered more than adequate to eliminate any risk of significant direct and indirect noise and vibration impacts on otters during the construction of the proposed development. Therefore, no further mitigation is required in respect of noise and vibration impacts on this species.

Lighting

The mitigation prescribed for impacts of artificial lighting (above) are considered more than adequate to eliminate any risk of significant such impacts on Otter during the construction and operation of the proposed development. There will be no spillage of light to the river or to land within 10m of the river banks. Therefore, no further mitigation is required in respect of lighting impacts on this species.

KER 4 – Bats

Habitat Fragmentation

The design of the proposed bridge provides ample clearances (c.3m) beneath the bridge deck for bats foraging over the river (TII, 2006b) in all but the worst storm events. These events are most common in winter months when bats are less active.

The following measures will be implemented to minimise the impacts on bats. Mitigation measures are recommended with respect to the maintenance of commuting routes for bats. These are based on best practice and the NRA guidelines. Provided that the recommended mitigation measures given within this report are adopted, it is considered that the impact on bats along the proposed new bridge will be neutral or imperceptible.

The guidance generally followed to provide mitigation measures for bats is:

- *Irish Wildlife Manual No. 25 published by NPWS 'Bats Mitigation Guidelines for Ireland* (Kelleher & Marnell, 2006).
- *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* (TII, 2006a)
- *Guidelines for the Treatment of Bats during the Construction of National Road Schemes* (TII, 2006b)

Lighting

The lighting design will ensure that no lighting is focused onto areas of ecological sensitivity including onto the River Suir and that lighting design provides for low levels of lateral light spillage to avoid unwanted areas of illumination.

KER 5 - Invasive Species

As discussed in Section 7.6.2 and Table 7.6.3 there is potential for invasive species to be spread during construction of the proposed development. The import or spread of invasive species has the potential to adversely affect the habitats and species within the River Suir. Therefore, the Contractor shall prepare a Biosecurity Protocol detailing his/her proposed approach to ensuring that invasive species are not imported or spread during construction. The Contractor's Biosecurity Protocol shall have the approval of the Ecological Clerk of Works prior to its acceptance and implementation.

The Biosecurity Protocol should include the following measures to prevent the spread of invasive species:

- Good construction site hygiene will be employed to prevent the introduction and spread of problematic invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving any site.
- All plant and equipment employed on the construction site (e.g. barges, piling equipment etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species
- All washing must be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the Construction Environmental Management Plan.
- Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present.

- All planting and landscaping associated with the proposed development shall avoid the use on invasive shrubs such as Rhododendron and Cherry Laurel.

Common Cordgrass

The non-native invasive species Common Cordgrass was recorded on the bank of the River Suir, immediately adjacent to the bridge construction envelope. According to the Saltmarsh Monitoring Project 2007-2008 (McCorry and Ryle, 2009):

"A general policy of active Common Cordgrass control in Irish saltmarshes is not *recommended.*

> *It is recommended that instead of attempting to control or manage established populations of Common Cordgrass in Ireland, the primary policy should be that any available resources should be used to prevent the spread of this species to new sites."*

7.7.3 Other Measures

Fish rescue

During the erection of cofferdams, there is a risk that fish may become trapped within. In order to prevent the death of these fish, they should be removed from the cofferdam during dewatering. Owing to the high conductivity, there is a significant Health & Safety issue with electrofishing within the cofferdams at this location. Therefore, rescue of any fish present within the cofferdams should be carried out using nets as the cofferdam is being dewatered.

7.7.4 Monitoring

Details of the monitoring of the mitigation measures prescribed in Sections 7.7.1-7.73 above are explained in detail in Section 7.7.5 below as part of the description of how these measures are to be implemented.

Hydroacoustic monitoring

In order to allow for greater accuracy in the assessment of future plans and projects, it is recommended that hydroacoustic monitoring be undertaken for the full duration of the proposed development's construction. This monitoring should establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) and more accurately characterise the sound outputs in terms of SPL and SEL at different frequencies arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be carried out by specialist underwater noise surveyors and the results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works, who may make appropriate adjustments/improvements to the mitigation in this EIAR based on the result so this monitoring.

Record of intertidal habitats

In order to record any changes in the intertidal habitats, particularly mud habitats, in the vicinity of the proposed development, a photographic record shall be made of these habitats. This record shall cover both sides of the river from 150m upstream of the proposed bridge location to 300m downstream. All photographs shall be taken at low tide, every two months, beginning 6 months prior to commencement of construction and finishing 12 months after completion.

7.7.5 Implementation

In order to give effect to the mitigation prescribed in this EIAR, it should be a condition of any consent granted in respect of the proposed development that all of the mitigation, including monitoring and enforcement, prescribed in this EIAR be binding, during the construction phase, on the Contractor and, during operational phase, on WCCC. Accordingly, all of the mitigation prescribed herein shall be transposed into the Contract Documents for the construction of the proposed development.

During construction, all works must comply with relevant legislation and guidelines in order to reduce and minimise environmental impacts and to protect all ecological receptors. In particular, there must be full compliance with the following:

- The Schedule of Commitments.
- The mitigation prescribed in this Chapter of the EIAR and in the NIS.
- Any conditions which might be attached to the proposed development's planning consent.
- Any requirements of stakeholders and statutory bodies, e.g. the NPWS and IFI, including:
  - *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
- All applicable legislative requirements in relation to environmental protection.
- All relevant construction industry guidelines, including:
  - *C532 Control of water pollution from construction sites: guidance for consultants and contractors* (CIRIA, 2001).
- Any biosecurity requirements arising from the preceding points.
- The Transport Infrastructure Ireland (TII) and National Roads Authority (NRA) Environmental Assessment and Construction Guidelines, specifically:
  - *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes.*
  - *Guidelines for the Treatment of Bats during the Construction of National Road Schemes.*
  - *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.*
  - *Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes.*
  - *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes.*
  - *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes.*
  - *Guidelines on the Management of Noxious Weeds on National Roads.*
  - *Guidelines for the Treatment of Noise and Vibration in National Road Schemes.*
  - *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes.*
  - *Management of Waste from National Road Construction Projects.*
  - *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.*

This list is non-exhaustive. All environmental commitments/requirements and relevant legislation and guidelines which are current at the time of construction will be followed.

Environmental Management Plans

Construction Environmental Management Plan

Prior to any demolition, excavation or construction, the Contractor will be required to produce a Construction Environmental Management Plan (CEMP) describing the Contractor's overall management and administration of the construction of the proposed development. The CEMP will be prepared by the Contractor during the pre-construction phase to ensure that the proposed development is completed on time and within budget. The CEMP will include a detailed programme of works and budget and will also ensure that all construction activities are undertaken in a satisfactory and safe manner and to a programme which meets WCCC's requirements.

The CEMP will contain the following information of general importance:

- An overview of the proposed development.
- An organisational chart illustrating the structure of the Contractor's project team and the duties and responsibilities of the various members.
- The Contractor's communications strategy.
- The contact details of relevant persons/entities, e.g. the Safety Officer, the Site Environmental Manager and the emergency services.
- A list of the documents which will have informed the CEMP, including all relevant legislation and construction/environmental guidelines.

In relation to environmental management, the CEMP will provide and full list of the Contractor's environmental commitments and will detail the Contractor's approach to the following:

- Management of waste arising from construction and demolition.
- Control of sediment, run-off, erosion and pollution.
- Minimisation of noise and vibration impacts.
- Minimisation of artificial lighting and shading.
- Management of risk from invasive alien species.
- Response to emergencies/other incidents, including environmental incidents.
- Awareness of the surrounding environment and the Contractor's environmental commitments among site personnel.
- Monitoring, inspection and auditing of the Contractor's compliance with his/her environmental commitments.

Other topics covered by the CEMP will include the management of construction traffic and Health & Safety issues.

All of the mitigation measures prescribed in Section 7.7 of this Chapter must be effectively transposed into the appropriate sections of Contractor's CEMP.

Environmental Operating Plan

The Contractor's Environmental Operating Plan (EOP) will be prepared in accordance with *Guidelines for the Creation, Implementation and Maintenance of an Environmental* Operating *Plan* (NRA, 2007). The protection of European sites will be a core objective of the EOP, which will set out the Contractor's approach to managing environmental issues during the construction of the proposed development and detail how the Contractor will ensure the full and proper implementation of all of the mitigation prescribed in this Chapter and in other relevant documents. The details to be contained in the EOP include, as a minimum:

- All environmental commitments and mitigation stipulated in the planning documentation in respect of the proposed development, including sediment controls and other measures to ensure that water quality in the River Suir and Waterford Harbour is not degraded.
- Any requirements of statutory bodies such as the NPWS and IFI, including adherence to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
- A detailed Biosecurity Protocol.
- A list of all applicable legislative requirements in relation to environmental protection and a method of documenting compliance with these requirements.
- Outline methods by which construction activities will be managed in such a manner as to avoid, reduce or remedy potential negative impacts on the environment.
- An Incident Response Plan (described below).

<u>Incident Response Plan</u>

The Incident Response Plan (IRP) will form part of the EOP and detail the Contractor's planned response to fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incidents within an area of traffic management. This must include:

- Contact names and telephone numbers for the local authority, i.e. Waterford City & County Council (all sections and departments), An Garda Síochána and ambulance and fire services; and,
- Method statements for weather forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour. The plan must outline how the Contractor will respond to forecasted flood events, including but not limited to, details of removal of site materials, fuels, tools, vehicles and persons from flood zones.

<u>Construction and Demolition Waste Management Plan</u>

The Construction and Demolition Waste Management Plan (CDWMP) will detail the Contractor's proposals regarding the treatment, storage and recovery or disposal of waste. This plan will contain, but not be limited to, the following:

- Details of waste storage, e.g. skips, bins, containers, to be provided for different waste and collection times;
- Details of where and how materials are to be disposed of, e.g. landfill or other appropriately licensed waste management facilities;
- Details of storage areas for waste materials and containers;
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbons or chemical waste are to be stored and disposed of in a suitable manner; and,
- Details of how construction and demolition waste will be dealt with.

<u>Outline Environmental Management Plans</u>

The CEMP, the EOP, including the IRP, and the CDWMP are grouped together as Environmental Management Plans (EMPs).

Outline EMPs are included in Appendix 4.1 (a-d). These outline EMPs will be provided to the Contractor and it will be his/her responsibility to develop his/her own EMPs based on the outlines provided. Prior to their acceptance and implementation, the Contractor's EMPs will be subject to approval by the Site Environmental Manager and Ecological Clerk of Works (described below), as well as the Employer's Representative.

Site Environmental Manager

To ensure the successful development, implementation and maintenance of the EOP, the Contractor will appoint an independent Site Environmental Manager (SEM). He/she must possess training, experience and knowledge appropriate to the role, including a National Framework of Qualifications (NFQ) Level 8 qualification (or equivalent) or other acceptable qualification in environmental science, environmental management, hydrology or engineering. The principal functions of the SEM will be to ensure that the mitigation prescribed in this NIS, the EIAR, the CEMP, the EOP and the CDWMP, is fully and properly implemented and to monitor the construction stage from an environmental perspective. The SEM will also provide independently verifiable audit reports.

Separate from the on-going and detailed monitoring carried out by the Contractor as part of the EOP, the SEM will carry out the inspection and monitoring described below on behalf of WCCC. The results will be stored in the SEM's monitoring file and will be available for inspection or audit by WCCC, the NPWS or IFI.

- Daily reporting on weather and flood forecasting and daily reporting on the monitoring of water levels in the Lower River Suir.
- Weekly inspections of the principal control measures described in the CEMP and reporting of findings to the Contractor.
- Daily inspections of surface water treatment measures.
- Daily inspections of all outfalls to watercourses.
- Daily visual inspections of watercourse to which there are discharges from the works and those in the vicinity of construction works.
- Weekly inspections of wheel-wash facilities.
- Daily monitoring of any stockpiles.
- Auditing at least six times per quarter of the Contractor's EOP monitoring results.

Ecological Clerk of Works

In order to ensure the successful development and implementation of the CEMP, an independent Ecological Clerk of Works (ECoW) will be appointed. The ECoW must possess training, experience and knowledge appropriate to the role, including:

- An NFQ Level 8 qualification or equivalent or other acceptable qualification in ecology or environmental biology; and,
- Demonstrable experience in the protection of European sites.

The principal functions of the ECoW are:

- To provide ecological supervision of the construction of the proposed development and thereby ensure the full and proper implementation of the mitigation prescribed in this Chapter and in the NIS;
- To regularly review the outcome of the specialist hydroacoustic monitoring and, on that basis, make any necessary adjustments to the mitigation; and,

- To carry out weekly inspections and reporting on the implementation of the Contractor's Biosecurity Protocol.

In exercising his/her functions, the ECoW will be required to keep a monitoring file and this will be made available for inspection or audit by WCCC, the NPWS or IFI at any time.

7.8 Residual Impacts on Key Ecological Receptors

Table 7.18 Assessment of the Residual Impacts Scale and Significance; Based on the EPA (2002) and TII (2009)

Key Ecological Receptor	Pre-Mitigation Impacts	Ecological Significance Following Mitigation
KER 1 River Suir	Pre-mitigation impacts include the following: • Direct loss of habitat; • Habitat degradation and barrier effects (lighting, noise, vibration); and, • Potential accidental pollution.	The loss of estuarine habitat cannot be mitigated for as a small area falls within the footprint of the proposed development. The impact of this habitat loss will be a Permanent Slight Negative Impact at the local scale. Following the inclusion of the mitigation measures in Section 7.7 above, the probability of impacts on water quality arising from the construction of the proposed development are very low and the significance of any such impacts, if they were to occur, would be slight to imperceptible. The probability and significance of any such impacts arising from the operation of the proposed development are lower still.
KER 2 Migratory Fish	Pre-mitigation impacts include the following: • Habitat degradation and barrier effects (lighting, noise, vibration); and, • Potential accidental pollution.	No significant residual impact on this Key Ecological Receptor at any scale.
KER 3 Otter	Pre-mitigation impacts include the following: • Habitat degradation and barrier effects (lighting, noise, vibration); and, • Potential accidental pollution.	No significant residual impact on this Key Ecological Receptor at any scale.
KER 4 Bats	Pre-mitigation impacts include the following: • Barrier effects (lighting, noise, vibration); and,	No significant residual impact on this Key Ecological Receptor at any scale
KER 5 Invasive Alien Species (IAS)	Construction of the development may lead to the spread of IAS.	No significant residual impact on this Key Ecological Receptor at any scale.

7.9 Assessment of Cumulative Impacts

Cumulative impacts are impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the River Suir Sustainable Transport Bridge. Cumulative impacts were assessed by looking at all previous developments, current developments in planning and proposed future developments within 15km of the proposed site location from 2008 to 2018.

Beyond 5 years into the future, there is too much uncertainty associated with development proposals and therefore this EIAR can only be based on data that is readily available.

This assessment has considered cumulative impacts that are:

(a) Likely;

(b) Significant; and,

(c) Relating to a future event, reasonably foreseeable.

Data sources included the following:

- Waterford City & County Council (planning and roads sections)
- Kilkenny County Council (planning and roads sections)
- An Bord Pleanála website (planning searches)
- Web search of windfarm projects in Waterford City and County and Co. Kilkenny
- General web search for major infrastructure projects in Waterford City & County and in Co. Kilkenny
- Waterford City Development Plan 2013-2019
- Waterford County Development Plan 2011-2017
- Kilkenny County Development Plan 2014-2020
- Ferrybank Belview Local Area Plan 2009-2020 (including Amendment 1)
- Coillte Website
- Inland Fisheries Ireland (IFI) website
- The National Spatial Strategy

Cumulative impacts between the River Suir Sustainable Transport Bridge and other plans and projects are described in Chapter 17: Inter-relationships and Cumulative Impacts.

7.10 Conclusions

This chapter has assessed the ecological impacts of the construction and operation of the River Suir Sustainable Transport Bridge on Biodiversity. The assessment described herein has examined the receiving natural environment and identified the Key Ecological Receptors likely to be impacted upon by the proposed development, namely the River Suir, Migratory Fish, Otter, Bats and Invasive Alien Species. Each Key Ecological Receptor was characterised in terms of their conservation value on a geographical scale. The chapter has analysed the potential impacts of the proposed development on these Key Ecological Receptors and characterised their likely effects in terms of their magnitude, extent, duration, frequency and reversibility, thereby determining their significance on a geographical scale.

One Key Ecological Receptor (River Suir) will be permanently affected by the proposed development relating to direct habitat loss within the footprint of the proposed development. However, given the small area of loss this impact is not considered to be significant. There will be slight to imperceptible impacts to water quality in the River Suir arising from the proposed development.

The NIS concluded, in view of best scientific knowledge and the Conservation Objectives of European sites, that the River Suir Sustainable Transport Bridge, either individually or in combination with other plans or projects, will not adversely affect the integrity of the Lower River Suir SAC or the River Barrow and River Nore SAC or any other European site.

Provided that the River Suir Sustainable Transport Bridge is constructed and operated in accordance with best practice guidelines and the mitigation measures described, there will be no likely significant effects on the ecology of the Zone of Influence at the international, national, county or local level.

There are no other residual effects likely to be significant at the local, county, national or international level. Furthermore, the assessment found no likely significant effects arising from the cumulation of the impacts from the River Suir Sustainable Transport Bridge with the impacts from other past, present or reasonably foreseeable developments.

Following consideration of the residual (post-mitigation) impacts, it is noted that the River Suir Sustainable Transport Bridge will not result in any significant impacts on any of the identified Key Ecological Receptors.

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Appendix 7.1
Marine Mammal
Risk Assessment

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Marine Mammal Risk Assessment of the River Suir Sustainable Transport Bridge

Prepared by
Dr Simon Berrow
April 2018

IWDG Consulting, Merchants Quay, Kilrush, Co Clare

1 | INTRODUCTION

The Irish Whale and Dolphin Group (IWDG) were contracted by the engineering and environmental consultants Roughan and O'Donovan, on behalf of Waterford City and County Council, to carry out a Marine Mammal Risk Assessment (MMRA) of the proposed River Suir Sustainable Transport Bridge to be constructed in Waterford City. The proposed construction site is not in, or adjacent to, any protected sites for marine mammals. The proposed works will take place over 20 months at a time informed by this MMRA.

Figure 1. Location of proposed bridge in Waterford City

Proposed works

The proposed works will occur on the north and south quays of the River Suir, which runs through Waterford City and in the river itself.

On the South Quay landing point, at the Clock Tower, there will be breakout required of sections of existing pavement and excavation of ground behind the south quays wall to allow for abutment construction. Bored piling will be performed behind the quay wall. The existing reinforced earth south quay wall will likely be demolished and replaced with a sheet pile wall.

On the North Quay there will be demolishing required of sections of existing North Quay structure (piles, beams and slab deck) to accommodate bridge abutment behind the existing wharf edge. Abutment piling from wharf will be achieved from a jack up barge in the water.

In the river itself, temporary works braced sheet pile cofferdams will be constructed from a jack-up pontoon or barge to allow for construction of the main span piers. Pier steel cased reinforced concrete bored piles will be installed within the confines of the cofferdams using a crane mounted drilling rig operation from the jack-up barge/pontoon. Three steel casings for bored piles will be driven, vertically, to required pile depth from a crane mounted piling rig on jack-up barge/pontoon, for each intermediate pier.

2 | METHODS

This risk assessment was based on a review of the available literature and data sources. Maps of the distribution of cetacean sightings on the approaches, and within Waterford City, were prepared using data from the Irish Whale and Dolphin Group's casual sightings database (IWDG, accessed April 2018). A site visit was not deemed necessary.

3 | LEGAL STATUS

Irish cetaceans and pinnipeds are protected under national legislation and under a number of international Directives and agreements to which Ireland is a signatory. All cetaceans, as well as grey and harbour seals, are protected under the Wildlife Act (1976) and amendments (2000, 2005, 2010 and 2012). Under the act and its amendments it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected species (except under license or permit). The act applies out to the 12 nml limit of Irish territorial waters.

All cetaceans and pinnipeds are protected under the European Commission (EC) Habitats Directive 1992. All cetaceans are included in Annex IV of the Directive as species 'in need of strict protection'. Under this Directive, the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) are designated Annex II species which are of community interest and whose conservation requires the designation of Special Areas of Conservation (SAC).

Ireland is also signatory to conservation agreements such as the Bonn Convention on Migratory Species (1983), the OSPAR Convention for the Protection of the Marine Environment of the northeast Atlantic (1992) and the Berne Convention on Conservation of European Wildlife and Natural Habitats (1979).

In 2007, the National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht produced a '*Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters* (NPWS, 2007)'. These were subsequently reviewed and amended to produce '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*' (NPWS, 2014) which include mitigation measures specific to dredging. The guidelines recommend that listed coastal and marine activities (including dredging) be subject to a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process.

Once the listed activity has been subject to a risk assessment, the regulator may decide to refuse consent, to grant consent with no requirement for mitigation, or to grant consent subject to specified mitigation measures.

4 | BASELINE ENVIRONMENT

4.1 | Ambient Noise Levels

The ambient noise levels at the site are not known. Ambient noise along this section of the River Suir at Waterford City is expected to be dominated by environmental noise (e.g. tidal movement of water and sediment) and shipping noise, especially with peaks in noise due to large vessels transiting the river to berths in Waterford City.

4.2 | Cetaceans

A review of cetacean (whale, dolphin and porpoise records) submitted to the IWDG during the period 1 January 2000 to present was accessed on 5 April 2018 and mapped. To date, 51 validated records were available of at least three species.

Table 1. Cetacean sightings (including IWDG downgrades) recorded in the approaches to and within Waterford City from 2000-2018.

Species	Number of sightings	% of total
Harbour Porpoise	27	53
Common dolphin	18	35
Bottlenose dolphin	2	4
Dolphin sp.	3	6
Dolphin possibly harbour porpoise	1	2
Total	**51**	**100**

Most sightings in or adjacent to the area of interest were reported downriver of Waterford City in the upper reaches of the estuary. Harbour porpoise were the most frequently reported species with 27 or 53% of all records, followed closely by common dolphin with 18 records (35%). Bottlenose dolphin were also identified all downriver in the estuary (Table 1). Both harbour porpoise and common dolphin were reported near Waterford city.

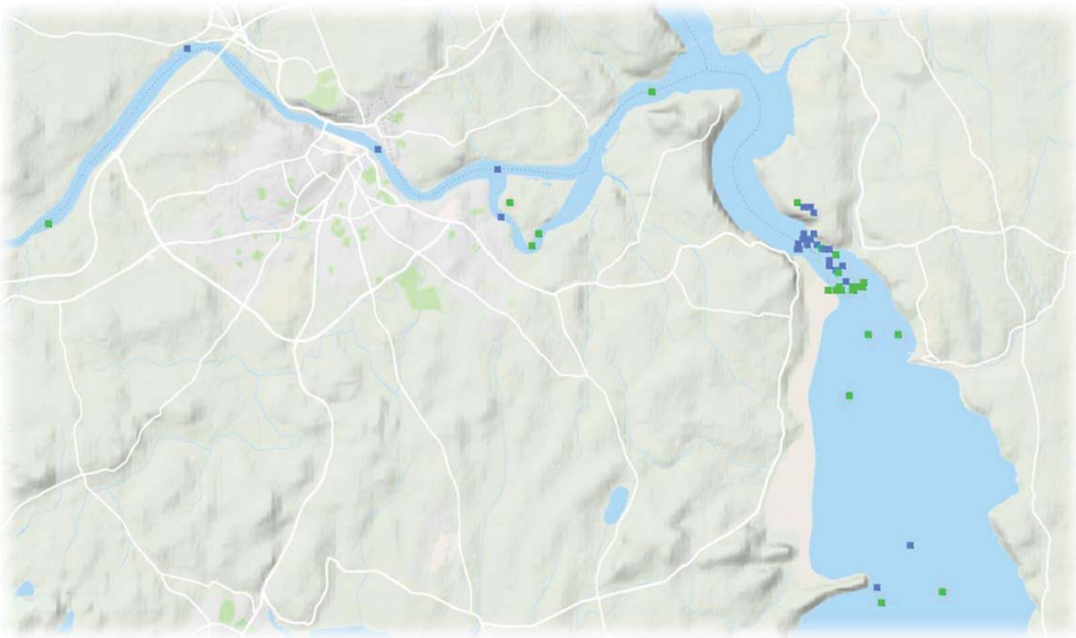

Figure 2. Map of all cetacean sightings submitted to the IWDG between 2000 to present in, and adjacent to Waterford city and downriver towards the approaches to the Celtic Sea (blue dots are harbor porpoise, green dots are dolphins)

A more detailed assessment of the most frequently recorded species is presented below:

Harbour porpoise (Phocoena phocoena)

Harbour porpoise are the most widespread and abundant cetacean in inshore Irish waters, with highest abundances in the Irish Sea (Berrow et al. 2010). Harbour porpoise have been sighted throughout the River Suir both in and down river of Waterford City. Most sightings were north of Duncannon around 6km downriver of Waterford city, but on three occasions they were sighted within the city and once upriver of Waterford City. Three of these sightings were between 26 September and 3 October 2015 and might be of the same group of 1-2 individuals.

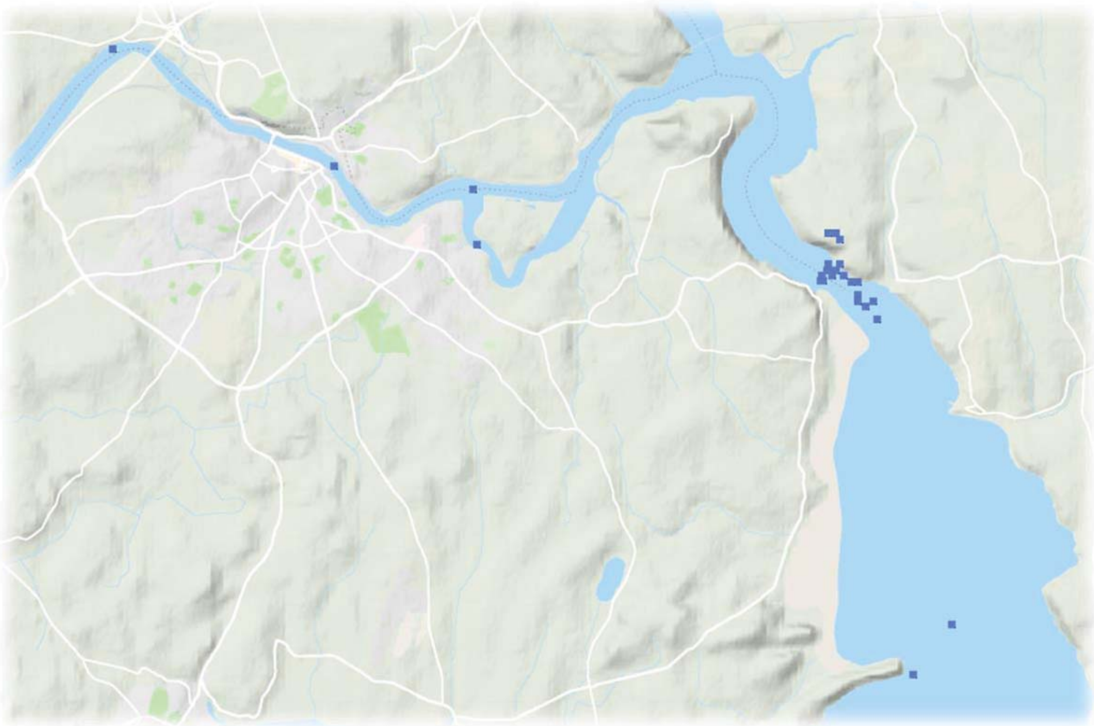

Figure 3. Sighting records of harbour porpoise (from IWDG accessed May 2017) in, and adjacent to Waterford city and downriver towards the approaches to the Celtic Sea

Harbour porpoise are known to particularly associate with areas of strong tidal currents for foraging. Sightings of harbor porpoise have occurred throughout the year with peaks in numbers during the spring and autumn, likely associated with fish moving up the river.

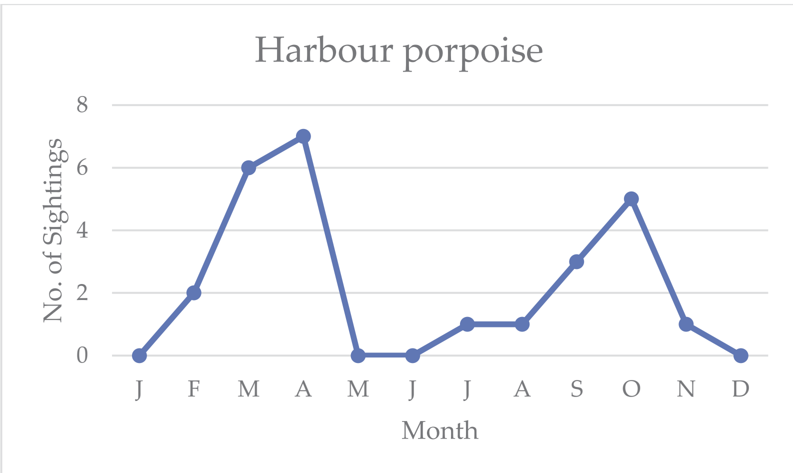

Fig. 4 Monthly distribution of Harbour Porpoise sightings in area shown in Fig 3.

Common dolphin (Delphinus delphis)

Common dolphins are distributed around the entire Irish coast but highest concentrations are off the southwest and west coasts (Berrow et al. 2010). However, in the winter large numbers of common dolphins enter the Celtic Sea to feed on schools of pelagic fish such as herring and sprat. Common dolphin were sighted throughout the River Suir both in and down river of Waterford City from 1 January 2000 to present (5 April 2018). Most sightings were north of Duncannon, around 6km downriver of Waterford city but on one occasion a group of 4 individuals were sighted within the city on 7 November 2016 and once one individual was sighted upriver of Waterford City on 30 August 2017 (Figure 5).

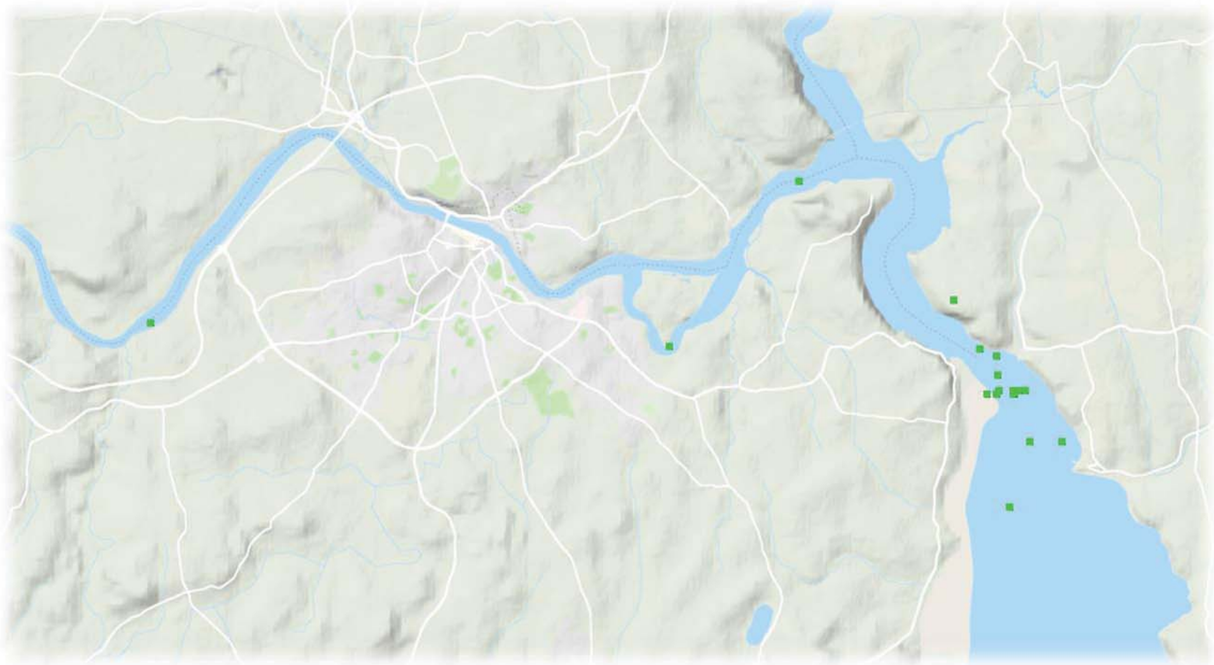

Figure 5. Sighting records of Common Dolphin (from IWDG accessed May 2017) in, and adjacent to Waterford city and downriver towards the approaches to the Celtic Sea

Sightings of Common dolphin are almost exclusively confined to the winter and is likely to be associated with fish moving up the river.

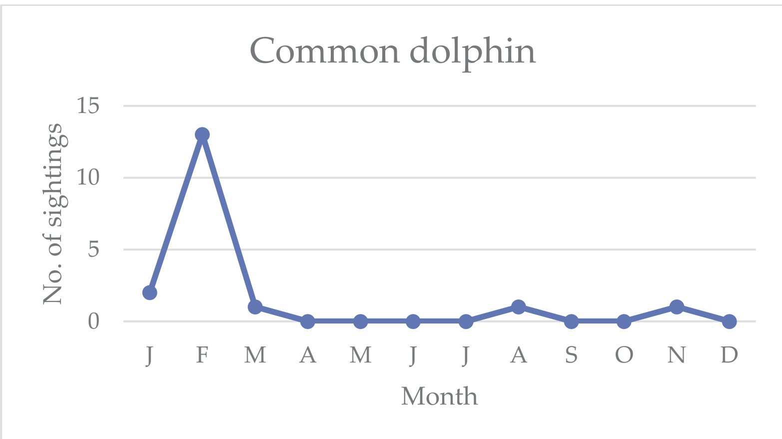

Fig. 6 Monthly distribution of Common dolphin sightings in area shown in Fig 3.

Bottlenose dolphin (Tursiops truncatus)

Bottlenose dolphins are infrequently recorded off Counties Waterford and Wexford and even more rarely up the River Suir (Figure 7). Bottlenose dolphins are widespread and relatively abundant off the Irish coast with most sightings along the western seaboard (Berrow *et al.* 2010). Recent genetic evidence (Mirimin *et al.* 2011) suggests the existence of three discrete populations of bottlenose dolphins in Ireland: the Shannon Estuary, an inshore population and an offshore population that ranges from the Bay of Biscay and the Azores (Louis *et al.* 2014). The inshore population is highly mobile and photo-identification has shown individuals recorded off Co Waterford to be part of this population (O'Brien et al. 2009).

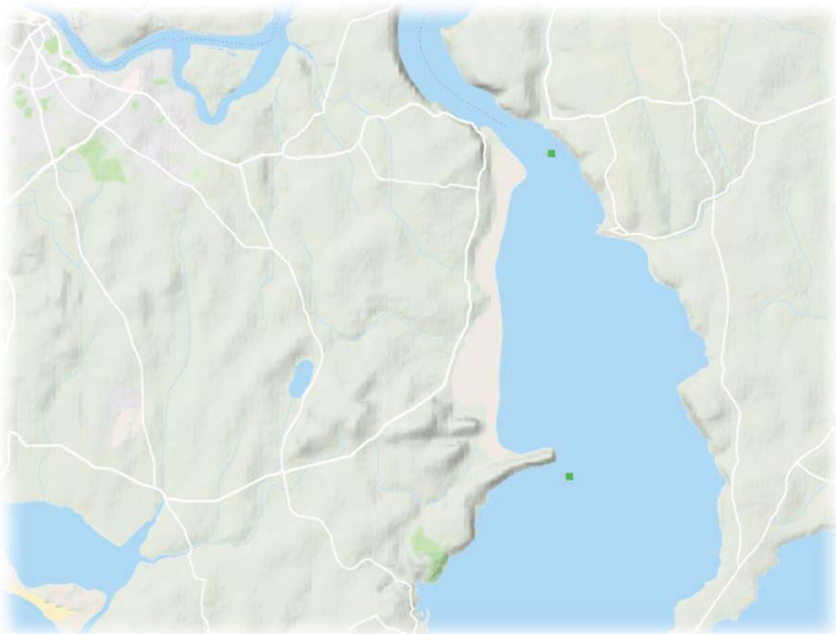

Figure 7. Sighting records of bottlenose dolphin (from IWDG accessed May 2017)

Sightings of bottlenose dolphin are rare and have occurred in January and August.

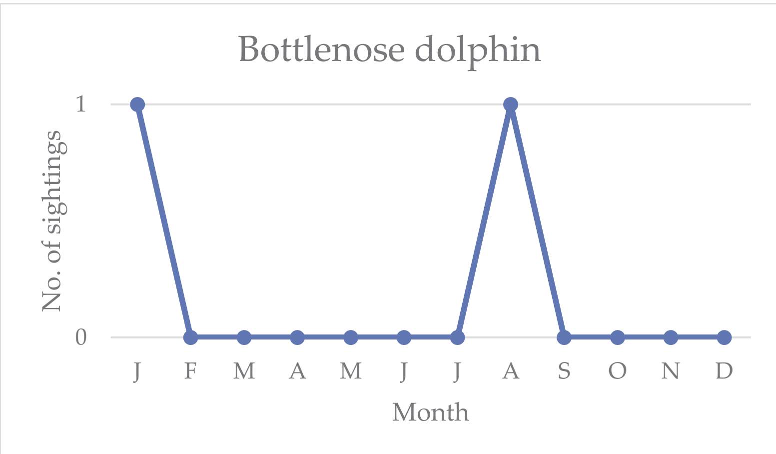

Fig. 8 Monthly distribution of Bottlenose dolphin sightings in area shown in Fig 3.

4.3 | Pinnipeds

Grey and harbour seals are distributed around the entire Irish coast with grey seals being more abundant along the western seaboard (Cronin *et al.* 2004; O'Cadhla *et al.* 2007; O'Cadhla and Strong 2008).

Harbour Seal (Phoca vitulina)

There were no harbour seal haul-out or breeding sites recorded near Waterford city during the National Parks and Wildlife Service (NPWS) surveys during 2002 or 2003.

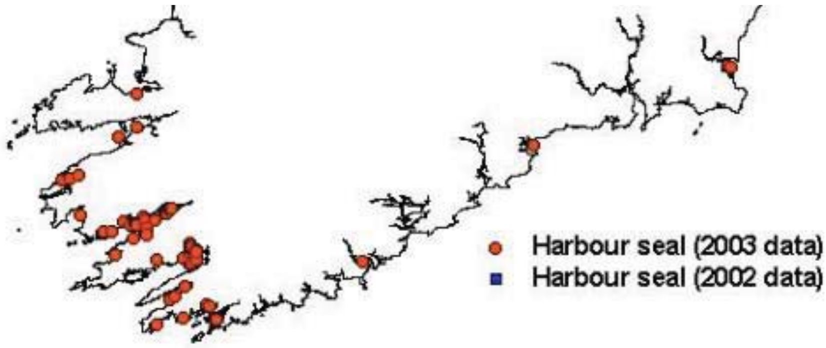

Figure 9. Map of the locations of groups of harbour seals recorded on the south coast of Ireland, August 2003 (from Cronin et al., 2004).

Grey Seal (Halichoerus grypus)

An important breeding, pupping and haul out site for grey seals occurs on Great Saltee Island (O'Cadhla *et al.*, 2007) which is 40km to the southeast and is designated as an SAC (site code 000707) with grey seal as a qualifying interest. The conservation status of grey and harbour seals in Ireland has been assessed as favourable (NPWS 2008, 2014). Grey seals forage locally and may also range long distances and may occasionally swim upriver when foraging.

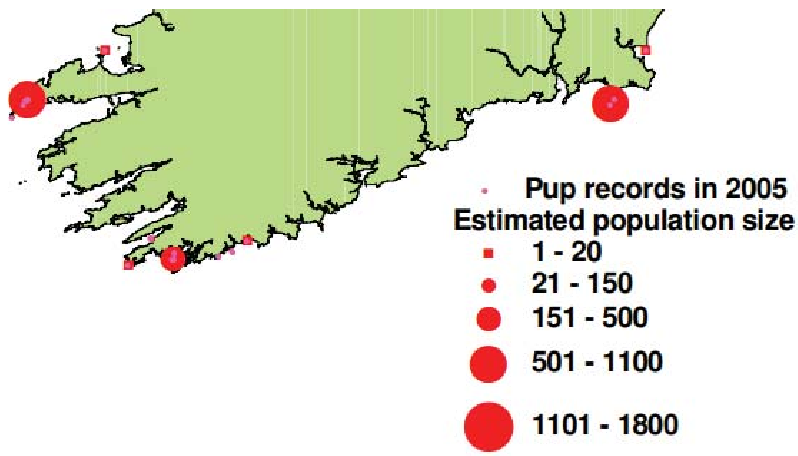

Figure 10. Map of the locations of grey seals pupping locations recorded on the south coast of Ireland in 2005 (from O'Cadhla et al., 2007).

5 | IMPACT ASSESSMENT

5.1 | Description of Activities

As part of the proposed site works the activities with potential to impact on marine mammals include:

5.1.1 Demolition of existing structures

Excavation of existing pavement, piles, beams and slab deck and ground will be limited to the banks to allow for abutment construction.

5.1.2 Piling Impacts

Most concerns of the effects of pile driving on marine mammals has been around the construction of offshore wind farms (Richardson *et al.* 1995). There has been limited work on the effects of piling during coastal and harbour works. Attenuation of sound pressure levels at coastal sites will be more rapid depending on the topography and nature of the bedrock. Recently, Graham *et al*. (2017) modelled the source levels estimated for impact piling from a single-pulse sound exposure level of 198 dB re 1 lPa2 s and, for a 192 dB re 1 lPa source level for vibration piling during harbour construction works. Predicted received broadband Sound Exposure Level (SEL) values 812 m from the piling site were markedly lower than source level due to high propagation loss of 133.4 dB re 1 lPa2 s (impact) and 128.9 dB re 1 lPa2 s (vibration). Simultaneous acoustic monitoring of bottlenose dolphins and harbour porpoises at the site showed they were not excluded from sites in the vicinity of impact or vibration piling; nevertheless, some small effects were detected with bottlenose dolphins spending a reduced period of time in the vicinity of construction works.

As the likelihood of any marine mammals being in the vicinity of the construction site is extremely low there is an insignificant risk of sound exposure and impact due to piling.

5.1.3 Increased marine traffic

Increased vessel traffic is restricted to one seagoing craft required to transport a seagoing barge to the site.

5.2 | Literature Review of Impacts and Mitigation

The NPWS (2014) '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters – January 2014*' recommends that listed coastal and marine activities undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process. It is required that such an assessment must competently identify the risks according to the available evidence and consider (i) direct, (ii) indirect and (iii) cumulative effects of anthropogenic sound (NPWS, 2014). Excavation of coastal structures is not specifically listed in the NPWS (2014) guidelines but piling is covered and is of concern if large piles are to be driven and there is a risk of exposure to marine mammals.

The works are assessed for their potential to create increased noise disturbance on the receiving environment.

A risk assessment, following NPWS Guidelines, was conducted based on the published literature, data from the IWDG sightings databases and knowledge of the study area.

Construction Impacts

While sound exposure levels from such operations are thought to be below that expected to cause injury to a marine mammal, disturbance from the noise generated by the construction activities, from the physical presence of sea going barges, and possibly from the increased water turbidity in the area of operations have the potential to cause lower level disturbance, masking or behavioural impacts, for example (NPWS, 2014). The activities of a long reach excavator will lead to a very localised increase in noise levels and the use of seagoing barges to a very slight increase in vessel traffic and associated noise. Small work vessels produce low frequency sounds (Table 2). The presence of an additional small vessel and the associated noise produced, is very unlikely to have a significant impact on marine mammals, as marine mammals are only very occasionally recorded and only then for very short periods.

Table 2. Estimated noise emissions from small workboat / tug (Wyatt, 2008)

Vessel Type	Displacement Tonne	Length (m)	Propulsion	Activity	Measurement	Measurement band kHz	Extrapolation dB re 1µPa m peak to peak	Reference
Tug with Barge	Tug Gross tonnage 104	19.5 (64ft)	Main engine 1095 hp diesel	Unloaded Speed 7.4 knots	173 dB re 1µPa @1m Source level	0.01 to 20	182 Broadband 10 to 2500 Hz with broad peak between 60 and 600Hz	Zykov and Hannay 2006

5.3 | NPWS Assessment Criteria

1. **Do individuals or populations of marine mammal species occur within the proposed area?**

The likelihood of marine mammals being in the area is low. Only harbour porpoise and common dolphin have been reported up the river as far as Waterford City and common dolphin nearly exclusively in the winter. There is an important pupping and haul out site for grey seal on Great Saltee Island, but this is a 40km away and will not be affected. All are part of a larger population and very mobile.

2. **Is the plan or project likely to result in death, injury or disturbance of individuals?**

The project will not cause injury or death and is also extremely unlikely to cause local disturbance from noise associated with the project.

Noise Impact

The activities proposed during this project consist of demolition and piling operations. It is unlikely any noise generated will cause permanent or temporary hearing injury to a marine mammal as its unlikely any will be exposed to the operation due to:

- The inshore location of the site, in a narrow river; and
- The very shallow nature of the construction site.

Physical Impact

The risk of injury or mortality is considered very unlikely as marine mammals are rarely in the vicinity of the site.

3. Is it possible to estimate the number of individuals of each species that are likely to be affected?

No abundance estimates for cetaceans are available but all group sizes reported in the area are low, with the maximum of 4 common dolphins recorded in a single group.

The main span piers widen at their base (squat piers) and will have an approx. width of 3m at their base.

4. Will individuals be disturbed at a sensitive location or sensitive time during their life cycle?

It is anticipated that construction work will be 20 months in duration. Thus spans breeding times for all marine mammals but as they are rarely recorded at the site and there is no evidence of breeding or haul out sites there is no risk.

5. Are the impacts likely to focus on a particular section of the species' population, e.g., adults vs. juveniles, males vs. females?

There are no data to suggest that any particular seal or cetacean gender or age group have been reported at, or in the vicinity of the site.

6. Will the plan or project cause displacement from key functional areas, e.g., for breeding, foraging, resting or migration?

While harbour porpoise and common dolphins have been reported in the area, there are no regularly used areas in the vicinity of the construction site. Therefore, there are no important habitats.

7. How quickly is the affected population likely to recover once the plan or project has ceased?

While there may be temporary disturbance, all marine mammals in the area are accommodated to human activities and are likely to recover from any temporary disturbance within hours.

5.4 | Mitigation

No mitigation measures are required as the likelihood of any marine mammal being in the area is very low.

5.5 | Residual Impacts

No residual impacts are likely once construction is finished.

6 | SUMMARY

A number of marine mammals have been recorded in the River Suir, in and adjacent to Waterford city but their occurrence is so sporadic that it is extremely unlikely that any would be exposed to potential impacts from this development.

No mitigation is required.

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Chapter 8
Soils and Geology

ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 8 Soils and Geology

8.1 Introduction

This chapter considers and assesses the likely significant effects with regard to Soils and Geology associated with both the construction and operational phases of the proposed River Suir Sustainable Transport Bridge. The proposed pedestrian, cycle and public transportation bridge will link the North Quays to Meagher's Quay on the south side of the River Suir in Waterford City. The proposed bridge layout is presented in Figures 4.2, 4.3, 4.4 and 4.5 of Volume 3 of this Environmental Impact Assessment Report (EIAR) while the proposed construction sequence is indicated on Figures 4.8 to 4.11 in Volume 3 of this EIAR.

Measures to mitigate the likely significant adverse impacts of the proposed bridge are proposed and residual impacts are described. This chapter initially sets out the methodology used (Section 8.2), describes the existing soils and geology environment (Section 8.3), examines the predicted impacts of the proposed development (Section 8.4), proposes mitigation measures (Section 8.5), and identifies residual impacts (Section 8.6).

8.2 Methodology

This chapter is prepared having regard to the requirements of sub-sections 2 and 3 of Section 50 of the Roads Act 1993, as amended. It also has regard to the Environmental Impact Assessment (EIA) Directive 2014/52/EU and the following guidance documents:

- National Roads Authority (NRA 2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide;
- National Roads Authority (NRA 2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Environmental Protection Agency (EPA 2017) Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (EPA 2015) Advice Notes for Preparing Environmental Impact Statements;
- Advice notes on Current Practice in the Preparation of Environmental Impact Statements, published by the Environmental Protection Agency (EPA) (2003); and
- Guidelines on the information to be contained in environmental impact statements, published by the EPA (2002).

8.2.1 Summary of Available Information

Information was initially obtained for a wider area which includes Waterford North Quays, the area to the north of the River Suir along with the proposed pedestrian, cycle and public transportation bridge crossing of the River Suir covered in this report. Details of the general environment in the vicinity of the site are provided where applicable. This chapter has been prepared using information from the following sources:

Mapping

Geological mapping from the Geological Survey of Ireland, covering the subsoils and solid geology of the location of the proposed bridge was reviewed. Digital mapping available at www.gsi.ie/mapping also shows the quaternary geology along with aquifer vulnerability, known groundwater wells and existing ground investigation information.

Aerial Photography

Ordnance Survey Ireland (OSi) aerial photography was obtained in the vicinity of the proposed bridge crossing to identify large scale ground characteristics. The areas to the north and south of the river generally consist of made ground. Aerial photography to the north of the River Suir shows brownfield lands associated with the now derelict North Quays. A number of industrial buildings have been demolished recently. An existing wharf structure runs alongside the river at the North Quays. To the south of the river, car parking extends along the length of the quays.

Ground Investigations and Surveys

A detailed ground investigation was carried out by IGSL Ltd. between June and October 2017 for the North Quays area along with the proposed bridge. The scope of this investigation was determined from analysis of previous ground investigation findings from the GSI website, aerial photography and site walkovers performed by Roughan & O'Donovan Consulting Engineers.

The investigation objectives were to determine the subsurface conditions, the extent of soft ground, made ground and likely depths to rock and rock strength. The investigation was also designed to assess groundwater levels and to investigate the presence of any contaminants across the site. As part of the ground investigation contract, a contamination assessment of the site was also carried out by O'Callaghan Moran (OCM) who were engaged by IGSL Ltd.

In addition to the exploratory holes and in-situ testing, a marine geophysical survey was carried out at the location of the proposed bridge crossing by Apex Geo-services.

Site walkovers by Roughan & O'Donovan Geotechnical Engineers during these investigations have also helped to identify the ground conditions associated with the proposed bridge structure.

Findings of the ground investigation are reported in the Ground Investigation (GI) Factual Report (IGSL Ref 20157 November 2017) and GI Interpretative Report (IGSL Ref 20157 January 2018). The findings of the Tier 2 and 3 Contamination Assessment were reported in the document Tier 2 Site Investigation and Tier 3 Risk Assessment North Quays Waterford Port (OCM December 2017).

The findings of the geophysical surveys, ground investigations and the contamination assessment are hereby presented:

Geophysical Surveys

The marine geophysical survey consisted of seismic refraction along with underwater multichannel analysis of surface waves (MASW) which have been used to identify the soil and bedrock profile at the bridge crossing location across the river. This survey was undertaken on the 28th July 2017. Findings from the geophysical survey were reported in the Report on the Geophysical Investigation at Waterford North Quays (AGL 17059_01) produced by Apex Geoservices Limited. The area investigated as part of the geophysical survey is shown in Plate 8.1.

A total of three seismic refraction spreads were recorded across the site as indicated in Plate 8.1.

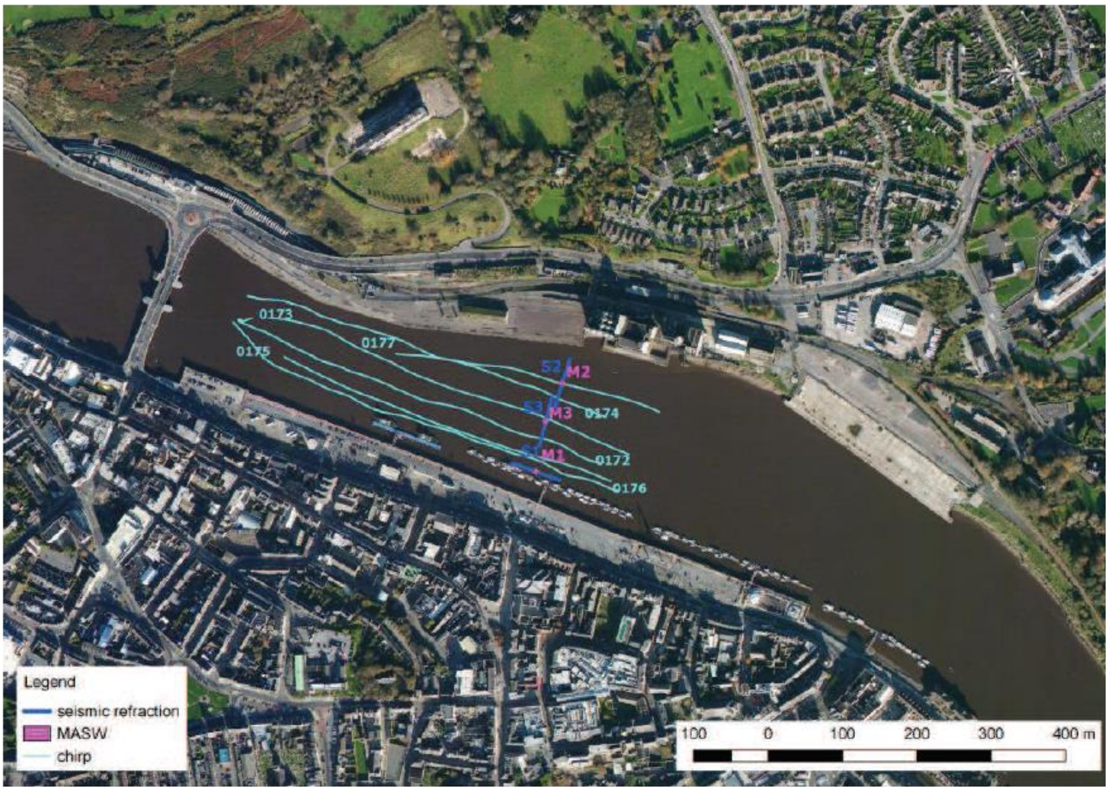

Plate 8.1 Geophysical Survey Site Location Plan

Strong currents in the river hampered deployment of the seismic refraction hydrophone receiver cable across the southern portion of the river. As a result of this, the geophysical survey undertaken was rotated through ninety degrees to improve the signal to noise ratio of the data.

In the central part of the river the currents also affected equipment and gun deployment resulting in a low signal to noise ratio. As a result, the data in the central part of the river could not be processed but Apex Geo-services Limited accessed sub bottom profiler CHIRP data to assist in interpretation of the sub surface profile.

The marine geophysical report includes the interpretation of the ground profiles.

The following conclusions and recommendations are relevant to the geotechnical constraints of the proposed bridge and approaches.

Ground Investigations

In total, the following exploratory hole information is available to assess overburden and bedrock characteristics at locations along the proposed bridge:

- 8 cable percussion boreholes with rotary follow-on (6 of these boreholes and rotary core holes were carried out over water).

The geologic profile is shown in Plate 8.2. The cross section also shows Rotary Core (RC)215 and RC216, located at the north quays. These boreholes are not relevant to the design of the proposed pedestrian, cycle and public transportation bridge.

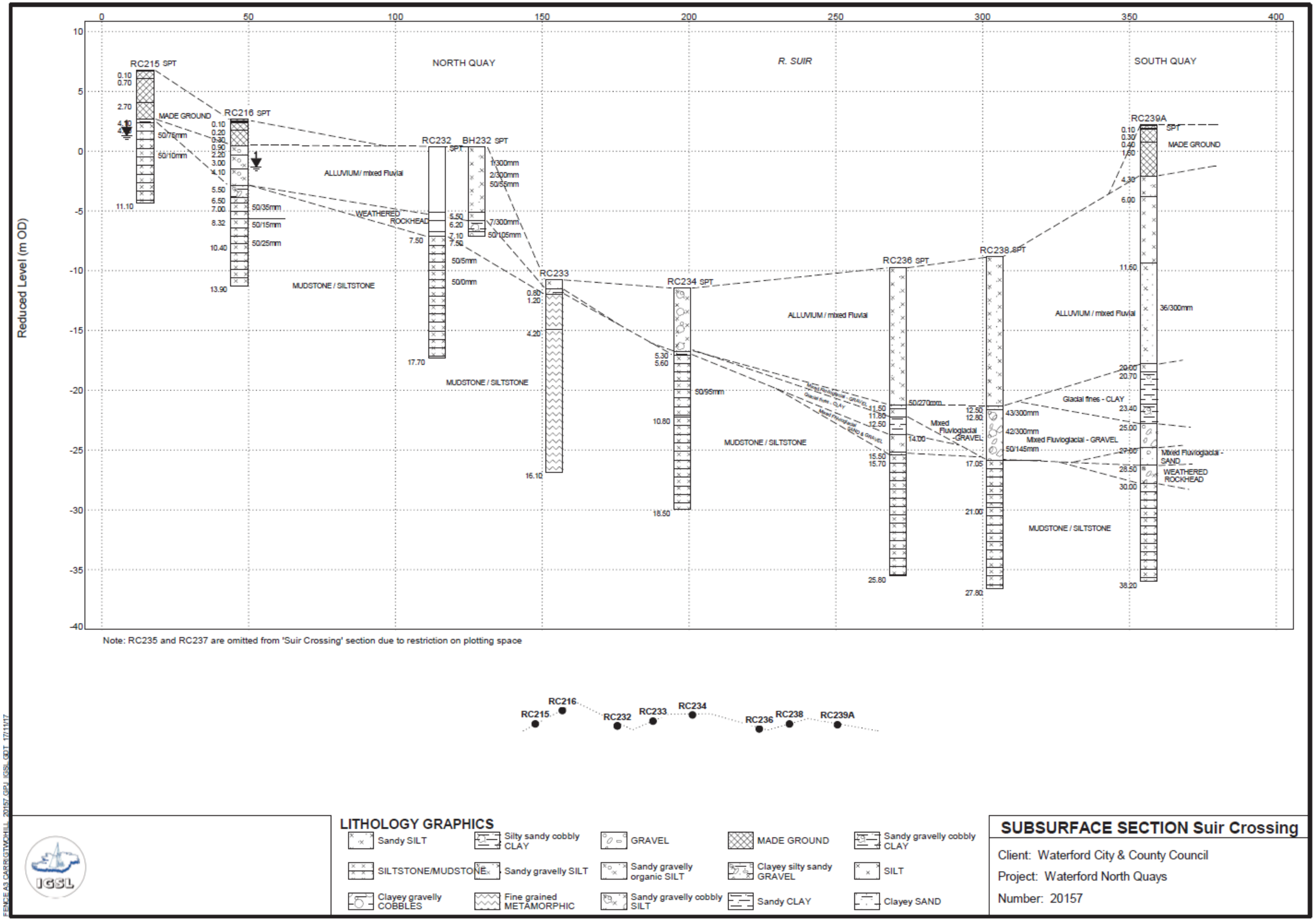

Plate 8.2: **Geological profile at the location of the proposed pedestrian, cycle and public transportation bridge crossing**

Geotechnical laboratory testing of selected samples collected during these works was carried out. Sufficient geotechnical information was available for the preliminary design of the proposed bridge structure.

Contamination Assessment

IGSL Ltd. requested O'Callaghan Moran & Associates (OCM) to complete a Tier 1 Risk Assessment in accordance with the EPA Guidance Document, Code of Practice (CoP) for Environmental Risk Assessment for Unregulated Waste Disposal Sites (2007), as specified in the scope of the ground investigation.

The Tier 1 Assessment identified potential contamination sources and recommendations were made for the completion of Tier 2 Site Investigations and the Tier 3 Risk Assessment. The Tier 3 assessment is based on the data collected from the investigation locations.

Samples taken from exploratory holes were sent to the Chemtest Laboratory in the UK for chemical testing. Results were assessed based on commercial and residential Suitable 4 Use Levels (S4ULs) developed in the UK for a range of land use settings ranging from residential with home grown produce to commercial settings and public open spaces near residential or commercial areas.

The commercial S4UL limits were not exceeded in any boreholes at the location of the proposed bridge.

The hazwaste online classification engine was used to determine the waste classification of samples recovered. Samples recovered from Bore Hole (BH) 235 at 1m, BH237 at 1m, BH239A at 1.5m, BH239A at 3m, BH239A at 4.5m and BH239A at 13m were classified as non- hazardous. Samples tested from BH239 also meet the inert limits.

8.3 Description of the Receiving Environment

The results of the geophysical investigation indicate the area is characterised by thin sediments over shallow weathered – fresh rock in the northern area with thicker sediments present in the south. There is no clear indication of a bedrock fault on either of the two seismic refraction spreads. The results of the geophysical survey indicate a 4 layer ground model across the site:

Layer 1 – Saturated Sediment:

In the south of the area (Profile S1), this layer is approximately 3.7m thick. In the north of the area (Profile S2), this layer is approximately 0.3 to 2.3m thick.

Layer 2 – Stiff / Dense Sediments:

In the south of this area, this layer is between 1.8 and 9.7m thick (Profile S1) and in the north (Profile S2) it is 0.5 to 2.9m thick.

Layer 3 – Highly / moderately weathered rock / very dense Gravel:

The depth to the top of this layer, on spread S2 varies between 2.6m and 13.4m below bed level (bbl) in the south and is between 1.0 and 4.9mbbl in the north (Profile S1).

Layer 4 – Slightly weathered / Fresh rock:

This layer is only present on profile S2. Where present, the depth to the top of this layer varies between 5.0m and 5.7m bbl, as presented in Plates 8.3 and 8.4 which are extracted from Factual Report (IGSL Ref 20157 November 2017).

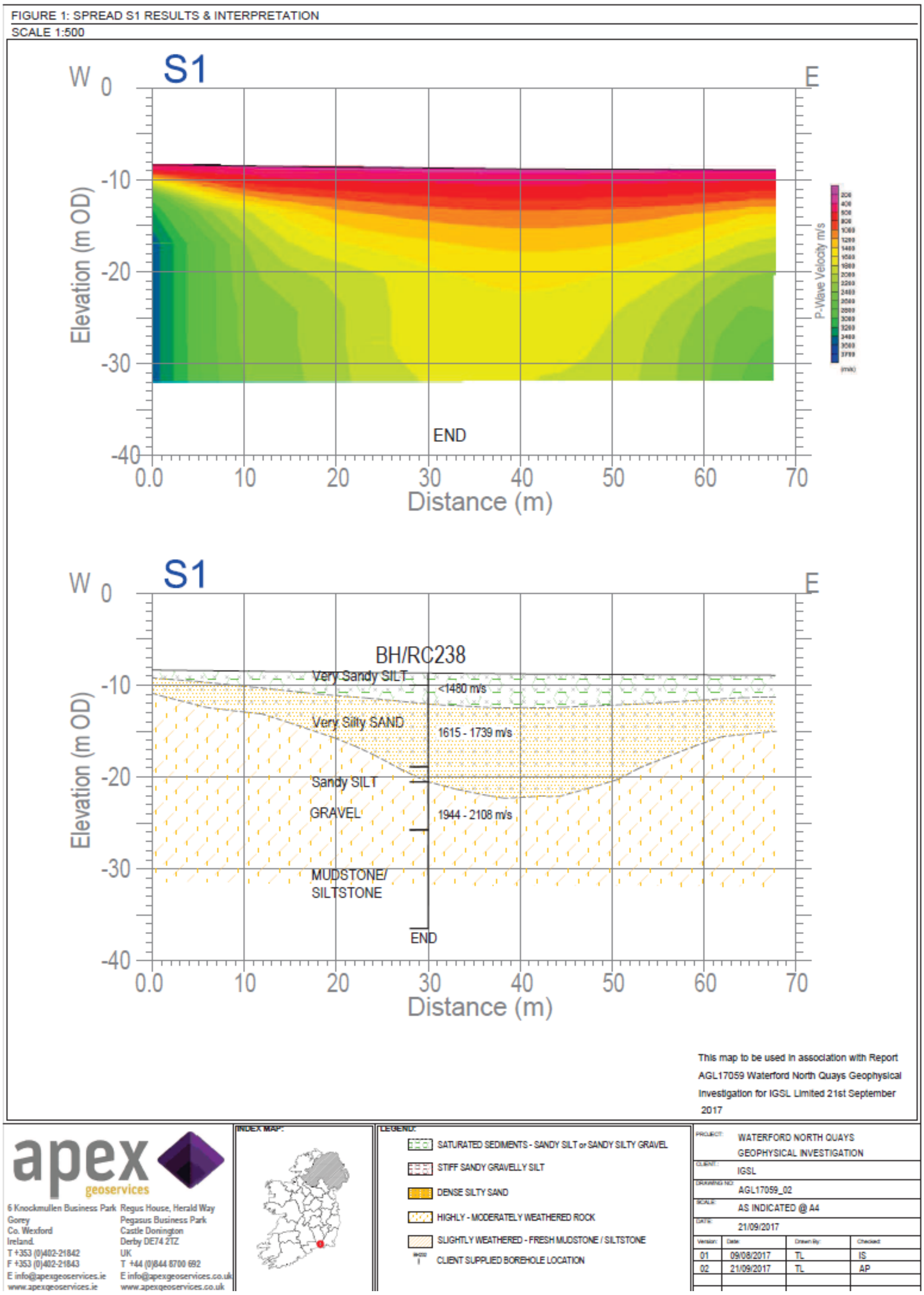

Plate 8.3 **S1 Results from Ground Investigation at the location of the proposed Sustainable Transport Bridge**

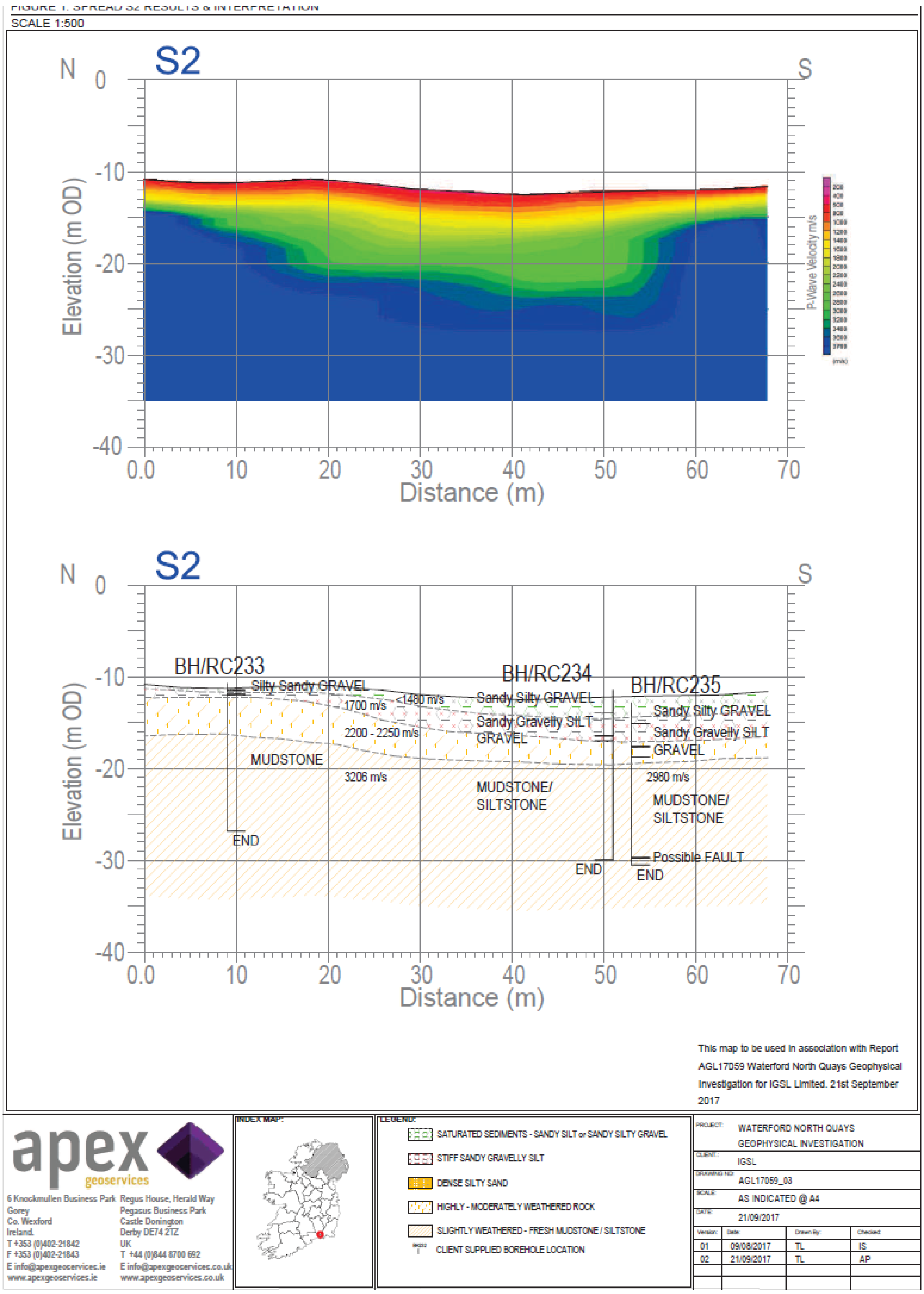

Plate 8.4 **S2 Results from Ground Investigation at the location of the proposed Sustainable Transport Bridge**

Existing Soils

<u>Alluvium and Alluvial Gravels</u>

Alluvial materials deposited by river action have been identified in areas along the proposed River Suir crossing from the marine boreholes and the boreholes carried out at the north and south abutments. These deposits generally consist of soft to very soft silts and very loose to loose sands and gravels, as presented in Figure 8.1 of Volume 3 of this EIAR. The depth of alluvium encountered ranges from 1.2mbbl (below bed level) in BH233 to 20.7mbgl in BH239A. In general, the thickness of alluvial material increases from north to south.

This information from rotary coring generally agrees with the interpretation of geophysical survey data indicating that alluvial thickness increases from north to south along with a decrease in the level of bedrock from north to south.

<u>Glacial Tills and Glacial Sands and Gravels</u>

The site is underlain by glacial till derived from sandstone. The depth range of the till occurring within the site has been confirmed by cable percussion borings during ground investigation. Glacial till material was generally encountered beneath the alluvial material and was noted as firm to stiff sandy gravelly Clay in BH232 from 6.2 to 7.1mbbl, in RC236 from 12.5 to 14mbbl and in RC239 from 20.7 to 25mbgl.

Sands and gravels were noted in BH236 from 10.5 to 15.7mbbl, in RC237 between 10.3 and 15.75mbbl, in BH238 from 12.5 to 17.5mbbl and in RC239 from 25 to 28.5mbgl.

<u>Made Ground</u>

Man-made ground is present at the north and south abutment locations of the proposed bridge structure. An existing reinforced concrete wharf structure is located at the north abutment and an existing reinforced earth quay wall is located at the south abutment. At the south abutment, car parking extends along the quay wall. BH239/239A, located at the south abutment and south plaza, encountered tarmacadam overlying granular fill material followed by dense granular fill material to a depth of 4.3mbgl.

Table 8.1 presents a summary of the properties of the soils discussed above.

Table 8.1 Typical Soil Properties

Soil Type	Particle Size / Type	Strength	Compressibility
Made Ground	Variable	Variable	Variable
Glacial Till	Fine and Coarse	Variable	Low-medium
Alluvium	Fine	Poor	High
	Coarse	Variable	Low - Medium

Existing Bedrock

Existing geological formations underlying the site have been identified from the Geological Survey of Ireland's (GSI's) geological online mapping for the area, as presented in Figure 8.2 in Volume 3. The site is underlain by Ballylane Formation from the centre of the river to the north and the site is underlain by Ross Member formation from the centre of the river to the south. The map also indicates a fault running along the River Suir.

The Ballylane Formation is described as green and grey slate with thin siltstone. Andesitic volcanic flows and tuffs occur locally and the formation is pyritic. The Ross Member formation is described as dark grey slate with thin siltstone. It consists predominantly of massive grey shale, shale with silty laminations, and thin greywackes with minor debris flow deposits and acid tuffs.

Due to the tectonic movements that occurred during and since volcanic activity, faulting is potentially present in the vicinity of the site. One large fault line in particular is shown to follow along the course of the River Suir. No evidence of this fault line was noted during the intrusive investigation. Much of the site is within the zone that may have been influenced by these movements. Faulting affects the quality of rock which can often be intensively fractured.

Coring at both land and marine borehole locations has proven siltstone, sandstone or interbedded mudstone rocks with discontinuities that are generally closely to widely spaced and with two sets of joints, typically at dip angles of 40° and 80°. Local degraded cubic pyrite is noted within the bedrock. Generally, at least 10m of predominantly solid rock core have been recovered from the boreholes. The variation in the depth to rock profile at the location of the bridge crossing is shown on the cross section in Plate 8.2.

8.4 Impacts of Development

8.4.1 Impacts on Soils

Bridge foundations will require construction of 1200mm diameter driven steel tubular piles at the north bridge abutment and pier locations. A combi-wall (combination of steel tubular piles and sheet pile panels) is proposed at the south abutment location in front of the existing quay wall to form the abutment foundations. Tubular piles will be installed using an impact hammer while sheet pile panels will be vibrated.

The south abutment of the bridge will tie into the south plaza approximately 1.8m above the existing quay ground surface level. This plaza level will reduce to the existing ground level at the existing Clock Tower.

A new sheet pile wall will be installed immediately in front of the existing quay wall at each side of the south abutment for a length of approximately 35m in order to retain the increased levels at the south plaza and approach to the bridge. The sheet pile will be installed using vibrating hammers. This solution can avoid the demolition and excavation of the existing quay wall, other than locally at tie in of the new sheet pile wall to the existing quay wall.

The raising of the levels at the South Quays for the purposes of the south plaza ramp will require the importation of a small amount of general fill. The fill's weight will induce the settlements in the underlying soft soils. If untreated, this would cause a significant long-term negative impact. The mitigation measures for this may include surcharging, (with or without vertical wick drains) or piling, explained in more detail in Section 8.5 Proposed Mitigation Measures. The surcharging will include the handling and temporary placing of a reasonably small quantity of general fill (approximately 1m height) on the ramp footprint, causing a slight temporary negative impact, for a period of up to 14 months. The piling option will be specified as Continuous Flight Auger (CFA) piles, which will minimise noise and vibration and introduce a need for disposal of a small quantity of arisings (less than 50 m^3), causing a slight short-term impact. The surcharge option will improve the geotechnical parameters of the existing soil, while the piling option would introduce new concrete foundation elements into the soil and is preferred in terms of reduced construction programme.

The existing floating jetty located at the south abutment will be removed at the bridge footprint. The impact associated with this operation is minor and adverse.

The north abutment construction will be performed in front of the existing north quay and will not require demolition of the existing wharf to execute piling. The north abutment will tie into the proposed north quays development which is located approximately 5.00m above the existing level of the north wharf. The impacts on soils associated with this location are likely to be negligible.

Cofferdams are required for construction of the foundation supports to the bridge piers within the river. Cofferdams will be constructed using vibratory driven sheet piles. During piling construction operations within the river, there is the potential for contamination of the river due to sediments and runoff associated with construction works or fuel spills entering the river. Mitigations to reduce adverse impacts to river water quality are described in Section 8.5. This impact is also examined in more detail in Chapter 9 Hydrogeology whilst noise and vibration impacts are considered in Chapter 12 of this EIAR.

8.4.2 Impacts on Solid Geology

No potentially significant adverse impact from the development on the solid geology (bedrock) of the site has been identified. No geologic heritage sites or accessible rock materials of economic value will be impacted.

Piling operations will install structural foundations through to competent bedrock. Rock sockets drilled to the specified diameter and installing concrete in the lower sections of piles may also be required in specific locations. Loading, stresses and deformations applied to the bedrock will be well within the capacity of the rock mass and tolerance of bridge structure. Piling construction and rock excavations will therefore have a negligible impact on the existing rock conditions.

8.5 Proposed Mitigation Measures

In general, the temporary and permanent impacts on soils and geology are considered minimal and will be managed by a number of best practice control measures including:

- All suitable material excavated for installation of pile caps shall be re-used to the greatest possible degree as fill material on the development;
- All unacceptable material excavated shall be disposed of in accordance with legislative requirements with due regard for the impact on the licensed waste disposal site. Where possible this material will be utilised in landscaping of the development;
- A geotextile screen and boom with oil barrier will be required around marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as setting and driving steel casings and boring in overburden or rock from polluting the river. An Incident Response Plan (IRP) shall also be required to deal with any unexpected spills during construction (See Appendix 4.1 A);
- Minimisation of excavation and removal of potentially contaminated soils where alternative engineering solutions can be used in the proposed development to ensure the existing ground is capable of providing adequate formation to the south plaza.
- Temporarily surcharging the footprint of the south plaza with an additional height of general fill in order to speed up the settlements in the underlying soft soils and alleviate the settlements in the operational phase. The surcharge will need to be held for 12 to 14 months. This hold period can also be significantly improved (down to 3 – 6 months) by installing vertical wick drains under the surcharge.

Installing of wick drains is fast and produces minimal noise and vibration over general construction traffic levels. After the surcharge hold period, the temporary surcharge can be reused in other areas such as in the proposed park areas.

- Surcharge height will be tapered back on the approach to the Clock Tower in order not to include the settlements to the protected structure. In addition, the Clock Tower will be equipped with the suitable monitoring equipment and instrumentation to closely monitor ground and vibration levels in real-time.
- In case a piling option is selected to prevent the settlements under the south plaza, CFA piles at suitable depth and spacing will be specified in order to avoid the excessive noise and vibrations in close proximity to the surrounding sensitive receptors.

8.6 Residual Impacts

No significant residual impacts of soils and geology are anticipated as a result of the proposed development.

Chapter 9
Hydrogeology

ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 9 Hydrogeology

9.1 Introduction

This chapter considers and assesses the likely significant effects with regard to Hydrogeology associated with both the construction and operational phases of the proposed River Suir Sustainable Transport Bridge in Waterford.

Measures to mitigate any likely significant adverse effects of the proposed River Suir Sustainable Transport Bridge are proposed and residual impacts are described. The chapter initially sets out the methodology used (Section 9.2), describes the existing hydrogeological environment (Section 9.3), examines the predicted impacts of the proposed development (Section 9.4), proposes mitigation measures (Section 9.5), and identifies residual impacts (Section 9.6).

9.2 Methodology

This chapter has been prepared in accordance with the following guidelines:

- Institute of Geologists of Ireland (IGI) (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (NRA 2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide;
- National Roads Authority (NRA 2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Environmental Protection Agency (EPA 2015) Draft Advice Notes for Preparing Environmental Impact Statements; and
- Environmental Protection Agency (EPA 2017) Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

9.2.1 Desk Study

A desk study of the study area of the proposed development was carried out in order to establish baseline conditions. The desk study involved collecting all relevant geological, hydrological, hydrogeological and meteorological data for the area. This included consultation with the following:

- Geological maps, Geological Survey of Ireland (GSI) (www.gsi.ie);
- Groundwater quality status maps (watermaps.wfdireland.ie);
- Teagasc Subsoils map (gis.epa.ie/Envision);
- Water Features, Rivers and Streams, EPA (gis.epa.ie/Envision);
- Geological Survey of Ireland – Groundwater Body Characterisation Reports;
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie);
- Protected areas, Biodiversity Ireland (maps.biodiversityireland.ie);
- Integrated Pollution Control (IPC) and Industrial Emissions (IE) Licences, EPA;
- Historic Maps from the Ordnance Survey of Ireland (www.osi.ie);

- Aerial Photography from the Ordnance Survey of Ireland (www.geohive.ie);
- Met Éireann historical weather data (www.met.ie).

9.2.2 Site Investigations

A walkover survey of the site and its environs was carried out by Roughan & O'Donovan in 2017. Following this initial site walkover, IGSL Ltd. were commissioned to carry out intrusive ground investigations for the North Quays and at the location of the proposed crossing. A Contamination Assessment of the site was also carried out by O'Callaghan Moran (OCM) as part of this site investigation. The intrusive ground investigations involved the drilling of exploratory boreholes with appropriate in-situ testing. In addition, a marine geophysical survey was carried out at the location of proposed bridge crossing by Apex Geo-services. This survey provided information regarding the nature of the soil and bedrock profile of the river bed at the location of the proposed bridge.

Further details of the findings of the geophysical surveys, ground investigations and the contamination assessment are presented in Chapter 8 Soils & Geology.

9.3 Description of the Receiving Environment

Soils & Subsoils

<u>GSI Mapping</u>

The Teagasc soil mapping identifies Made Ground for the area surrounding the proposed development. It is likely that the river is underlain by Alluvium and that the made ground on either quay is underlain/mixed with Alluvium material. Given the location of the site within Waterford City, it is likely that a variety of materials and soils are present beneath either quay. Refer to Figure 8.1 of Volume 3 of this EIAR for Teagasc soils mapping of the area.

<u>Intrusive Site Investigations</u>

Alluvium was encountered at a number of boreholes and in general increases in thickness from north to south. Site investigations encountered Glacial Till deposits beneath the Alluvial material and Sands and Gravels were also noted to be present at depth at a number of locations.

Bedrock Geology

<u>GSI Mapping</u>

The bedrock geology of the surrounding area is complex characterised by a faulted sequence of sediments and volcanics. The proposed crossing is underlain by the Ballylane Formation to the north of the river which is described as green & grey slate with thin siltstone. South of the river the site is underlain by the Ross Member Formation which is a dark grey slate with thin siltstone. A number of fault lines are recorded running both parallel and perpendicular to the River Suir. It is likely that the historic faulting in the vicinity of the site has either extended existing fracturing and/or has created additional fractures in the rock. Refer to Figure 8.2 of Volume 3 for GSI bedrock geology mapping of the area.

<u>Intrusive Site Investigations</u>

Site investigations identified siltstone, sandstone or interbedded mudstone rocks beneath the site. Depth to bedrock varies from 1.5m Below Ground Level (BGL) near the northern riverbank to more than 30m on the southern quayside.

Contaminated Land

Samples were taken from exploratory holes and were tested at the Chemtest Accredited Laboratory in the UK. All samples have been classified as falling within either the non-hazardous or inert limits. Some very low localised elevated levels of hydrocarbons (PAH) and heavy metals (Arsenic) were recorded, specifically in locations along the River Suir riverbed, however, levels were very low and only classify the material as very lightly contaminated.

Groundwater Resources

The River Suir forms a groundwater divide between rocks in terms of flow and productivity. The lands south of the River Suir are located within the Waterford Groundwater Body (IE_SE_G_149), which is predominantly characterised as comprising productive fissured bedrock. Given the fissured nature of the bedrock the aquifer is categorised as a Regionally Important Aquifer (Rf) - Fissured bedrock. North of the River Suir the site is within the Mullinavat Groundwater Body (IE_SE_G_155) whose flow regime is limited by predominantly poorly productive bedrock. Correspondingly, the bedrock underlying the site north of the River Suir is categorised as a Poor Aquifer (Pl) - bedrock which is generally unproductive except for local zones. Refer to Figure 9.1 of Volume 3 of this EIAR for GSI Aquifer and Groundwater Body (GWB) mapping of the area.

Groundwater Vulnerability

Groundwater vulnerability mapping for the site indicates that groundwater is moderately vulnerable to pollution at the ground surface. Having examined the site intrusive records for the area it is necessary to revise this rating taking into account local site conditions. North of the river subsoil cover forms a thin layer (generally <5m) of low to moderate permeability subsoil or made ground. Given that concrete and other impermeable materials may also be present, a vulnerability of extreme to high is appropriate. Subsoil thickness increases rapidly travelling across the River Suir towards the South Quay and given the presence of low permeability material groundwater vulnerability is likely moderate to low from approximately the centreline of the river at the proposed crossing location. Refer to Figure 9.2 of Volume 3 of this EIAR for GSI vulnerability mapping of the area.

Groundwater Recharge

Taking account of the low permeability and storativity of the Ballylane Formation, a recharge cap of 100mm has been assigned to these rocks indicating rejection of infiltration water annually. Recharge south of the river has been estimated at c.120mm per annum.

Site Hydrogeology

Given the proximity to the river and the topographical orientation towards the Suir valley, discharge from both Groundwater Bodies at the proposed crossing will be to the River Suir. Groundwater flow paths in the area north of the river will be very short due to the bedrock generally being poorly permeable with the exception of fracture zones. Flow paths to the south may be longer however, the proximity to the river is the dominant flow control.

Groundwater Abstractions

There are no recorded public groundwater supplies or group water schemes within the GSI database. There are a small number of recorded boreholes within 1.5km of the proposed crossing which are either for private domestic or light industrial use.

Groundwater Quality

Under the requirements of the Water Framework Directive (WFD), both the Waterford and Mullinavant groundwater bodies were classified as having an overall good status for water quality and quantity 2010-2015. An additional Groundwater Body – Waterford City (IE_SE_G_150) – is listed within the WFD mapping portal and is classified as having an overall poor status. Waterford and Mullinavant GWBs are classified as 'at risk' of not achieving at least good Ecological or good chemical status/potential by 2015. The objective for Waterford City GWB is 'restore'.

Site Conceptual Model

A Conceptual Site Model (CSM) was compiled showing the depth and extents of overburden, bedrock profile, location of surface water features and groundwater levels was compiled in conjunction with the Lands and Soils Assessment (refer to Plate 8.2 - Chapter 8). Groundwater flow is in a north-south direction towards the River Suir within the Mullinvant GWB. Groundwater flow is south-north towards the River Suir within the Waterford GWB. Groundwater levels are generally close to the ground surface (1-2m BGL) and are tidally influenced due to interaction with the river. The source-pathway model for risk identifies the necessity for a receptor when assessing the risk – in this case a likely significant impact. The site investigations included water quality analysis at some of the boreholes and Electrical Conductivity values observed at all sampled locations were in excess of 1500µscm^{-1} indicating brackish water as a result of the tidal influence. In this scenario, considering the aquifer immediately beneath the site as a resource (receptor) is considered to be a conservative approach as the salinity of the groundwater would limit its use as potable water supply. Given the likelihood for net discharge of freshwater to the river it is considered prudent to treat the aquifer as a receptor in the CSM.

Summary of Hydrogeological Features

The main features of importance identified at the site and in the study area are summarised in Table 9.1.

Table 9.1 Features of Importance

Feature	Importance	Criteria / Justification
Bedrock aquifer classified by the GSI as a Poorly Productive Aquifer which is productive only in local zones (Pl)	Low	A poorly productive aquifer is considered to be of low value on a local scale.
Bedrock aquifer classified by the GSI as a Regionally Important Aquifer comprising fissured bedrock (Rf)	High	A regionally important aquifer is considered to have a high quality or value on a regional scale
River Suir	Extremely High	* *See explanation below.*

* The River Suir is a hydrological feature of importance. The IGI guidance does not designate importance ranking to hydrological features, however the Transport Infrastructure Ireland (TII) guidance states that if groundwater supports a river or surface water body ecosystem protected by EU legislation (e.g. Lower River Suir Special Area of Conservation (SAC)) that it should be considered an attribute of extremely high importance.

9.4 Potential Impact Assessment

This section describes the impacts associated with the proposed development before mitigation measures are applied. Both direct and indirect impacts will be addressed for the construction and operation of the proposed development. The nature, extent and duration of the impacts will also be assessed.

The proposed development will involve the following activities during the construction phase which have the potential to impact the hydrogeological features of importance:

- Excavations during the construction stage which will be up to approximately 2.5 mBGL to construct the bridge abutments and foundations. The excavations may encounter material with very low levels of contamination.
- Construction of steel driven piles with rock sockets and the excavation and removal of in-situ material.
- Storage of stockpiles during the construction phase.
- Minor pumping may be required if groundwater is encountered during excavations, although this is expected to be very localised to the site. This groundwater may be contaminated.

During the operational phase, the area will be an urban environment covered in hard standing. There are therefore no perceived activities which pose a risk to the hydrogeological features of importance with the exception of the Lower River Suir SAC during the operational phase.

9.4.1 Construction Phase

During the construction phase the following activities may pose a potential impact:

- Excavation of made ground,
- Contamination of soils, and
- Contamination of groundwater.

Excavation of Made Ground

Excavation of made ground will take place during construction. The excavation of any localised areas of ground contamination will be a Permanent Positive impact on the soils environment due to the requirement to remove the material off-site and dispose or treat it in accordance with relevant legislation. Any improvement to the quality of soils will have a corresponding benefit to the underlying groundwater resources due to the removal of a potential source of contamination for percolating water. Therefore, the magnitude of this impact is Minor Beneficial due to a minor improvement to the attributes quality.

Contamination of Soils

There is a potential risk of localised contamination from construction materials leeching into the underlying soils by exposure, dewatering or construction related spillages resulting in a Permanent Negative impact on the soils. In the case of soils, the magnitude of this impact is Small Adverse as the requirement of good construction practices will necessitate the immediate excavation/remediation of any such spillage resulting in a very low risk of pollution to the soils and consequently the underlying aquifers. The significance of this impact is Imperceptible.

Contamination of Groundwater

There is a potential risk of localised contamination of the groundwater due to construction activities i.e. construction spillages, leaks from construction plant and material etc. resulting in a Permanent Negative impact on groundwater. The groundwater table is approximately 1 – 3.6m BGL in the vicinity of the River Suir. The bedrock has been proven at numerous locations ranging from 1.5m BGL to 30m BGL. Bedrock is generally overlain by either alluvium or alluvium overlying till. The presence of this low permeability alluvium (and tills) will limit the potential for contamination to infiltrate into the underlying aquifer.

However, the requirement to construct piles through the overlying soils, which have been shown to be slightly contaminated at discrete locations, could potentially create a preferential flowpath through the subsoils directly into the bedrock allowing some of these contaminates to mobilise. Expected construction practice will involve the piling to take place in the dry within temporary cofferdams. A base concrete slab will be constructed prior to pile installation to seal the potential pollution source. All foundation piles will be filled with concrete immediately after excavation preventing contamination of the bedrock aquifer. For these reasons, the impact is Negligible on the groundwater contained within the bedrock aquifer. The significance of this impact is Imperceptible.

9.4.2 Operational Phase

The operational phase of the proposed development is predicted to have an overall Neutral long-term impact on hydrogeology within the study area. During the operational phase runoff from the proposed development which may be polluted with either sediment or hydrocarbons/metals may enter the River Suir and degrade water quality. This potential impact and associated mitigation measures are fully considered in the surface hydrology impact assessment contained within Chapter 10 of this EIAR.

9.5 Proposed Mitigation Measures

9.5.1 Construction Phase

A project-specific Environmental Operating Plan (EOP) and Outline Construction Environmental Management Plan (OCEMP) have been prepared and appended to Chapter 4 of this EIAR (see Appendix 4.1 and 4.1 B respectively). They will be maintained by the Contractor for the duration of the construction phase. The EOP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the EOP for the proposed development will be formulated in consideration of the standard best practice. The EOP will include a range of site specific measures which include:

- Earthworks shall be carried out such that surfaces promote runoff and prevent ponding and flooding.
- Runoff will be controlled and treated to minimise impacts to surface and groundwater.
- Temporary pumping of groundwater shall be treated by means of a temporary sedimentation pond (or similar) prior to discharge
- All hazardous materials will be stored within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase.
- Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction.
- Mitigation measures during the construction phase will include implementing best practice during excavation works to avoid sediment entering the River Suir (refer to Chapter 10 of this EIAR for details).

9.5.2 Operational Phase

No mitigation measures are required during the operational phase providing the requirements as set out in Chapter 10 of this EIAR relating to the protection of water quality within the Lower River Suir SAC are implemented in full.

9.6 Residual Impacts

The incorporation of the mitigation measures outlined in Section 9.5 results in the magnitude of any impacts either during construction or operation to be considered as Negligible. As a result, the significance of all residual impacts is Imperceptible

Chapter 10
Hydrology

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Chapter 10 Hydrology

10.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents the hydrological assessment of the proposed construction and operational phases of the River Suir Sustainable Transport Bridge. This chapter sets out the methodology used in the assessment (Section 10.2), details the likely significant impacts associated with the construction and operational phase of the project (Section 10.4), describes measures to mitigate identified significant impacts (Section 10.5) and details residual impacts post mitigation (Section 10.6).

10.2 Methodology

10.2.1 Legislation and Guidelines

This chapter has been prepared having due regard to relevant legislation guidance documents which are listed below:

- EPA Guidelines on the Information to be contained in Environmental Impact Statements (2002);
- EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (2003);
- Draft EPA (Environmental Protection Agency) Guidelines on the Information to be contained in Environmental Impact Statements, October 2015 (referred to where appropriate);
- Draft EPA Advice Notes for Preparing Environmental Impact Statements, September 2015;
- NRA 2009 Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- NRA 2008 Guidelines for the crossing of watercourses during the construction of National Road Schemes.

10.2.2 Hydrology Assessment Methodology

The hydrological impact assessment methodology is in general agreement with the guidance outlined in Section 5.6 and 5.7 of the National Roads Authority (NRA) (Transport Infrastructure Ireland (TII)) Guidelines, 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA 2009'. The impact category, duration and nature of impact have been taken into account in this assessment as per the guidelines. The range criteria for assessing the importance of hydrological features within the study area and the criteria for quantifying the magnitude of impacts follow the NRA (TII) guidelines.

The hydrological assessment includes an assessment of published literature available from various sources including a web-based search for relevant material. Site specific topographical information and aerial photography has been reviewed to locate any potential features of hydrological interest, and these have been investigated on the ground by a walkover survey in order to assess the significance of any likely environmental impacts on them.

Available topographical and hydrometric information (field and desk based) has been used to perform hydrological impact assessments of the proposed watercourse crossing. All watercourses and water bodies which could be affected directly (i.e. crossed or realigned/ diverted) or indirectly (i.e. generally lie within 250m of the bridge crossing) were assessed through an initial walkover visit followed up by a detailed desk study and hydrological assessment.

10.2.3 Field Surveys

Field surveys and walkover assessments were carried out to assess the hydrological impacts of the proposed bridge development. A detailed bathometric survey (including floodplain topographical surveys where required) were made at areas where hydrological impacts were likely to occur.

Existing Information

A desk study was completed in order to obtain information on Hydrology using the following sources:

- Geological Survey of Ireland (GSI) – Bedrock Geology;
- Teagasc – Subsoil Map;
- Aerial Photography;
- Environmental Protection Agency (EPA) Surface Water Quality;
- EPA Viewer WFD Scores for Rivers, Transitional Water Bodies and Coastal Waters;
- OPW Preliminary Flood Risk Assessment Mapping (pFRA);
- OPW Catchment Flood Risk Assessment and Management Mapping (CFRAMs);
- Floodmaps web mapping;
- Waterford North Quays SDZ Flood Risk Assessment; and
- Geological Survey of Ireland (GSI) Web Mapping

10.3 Description of the Proposed Development

The new River Suir Sustainable Transport Bridge will carry pedestrians, cyclists and an electric courtesy bus. Surface water runoff from the bridge will not be permitted to drain freely from the bridge to the River Suir but will be collected in a closed system and will drain into surface water networks on the North Quays and the South Quays.

The bridge falls from the North Quay side to a lower level at the South Quay side, however as the bridge will have a lifting mechanism at central span, it will be necessary to drain both approach sections to the central span of the bridge separately and provide a drainage tie in connection at both the North and South Quay sides. The bridge surface water run-off will be collected in bridge deck drainage units and pipes (where necessary) which will be collected and fed into the surface water drainage network. The drainage network will convey storm runoff to a surface outfall location.

On the North Quays a closed system connection from the bridge and the plaza area will to be provided which will tie into the SDZ area's future drainage network.

On the South Quays runoff from the bridge and the new raised plaza areas will be collected and attenuated and will connect to the existing storm water network which then discharges to a combined sewer running from west to east along the R680 Meagher's Quay. There is an existing jetty at the proposed bridge location which will need to be removed. Two new jettys will be provided as part of the development on the south quays east and west of the bridge.

10.4 Description of the Receiving Environment

10.4.1 Regional Overview of Hydrology

The headwaters of the Suir are located on the eastern slopes of Benduff, North West of Templemore in Co. Tipperary. The Suir becomes tidal just before reaching Carrick-on-Suir, and is joined by a number of rivers between this point and Waterford city including the Lingaun, Portlaw Clodiagh, Pil, and Kilmacow Blackwater and then makes its way to the confluence with the Nore and Barrow Rivers east of Waterford City. The Suir estuary then turns south, flowing out to sea through Waterford Harbour between Dunmore East and Hook Head.

Surface water features located in the vicinity of the proposed River Suir Sustainable Transport Bridge are located entirely within the South Eastern River Basin District. The proposed River Suir Sustainable Transport Bridge crosses the River Suir in Waterford City from the Waterford North Quays SDZ to the clock tower on the South Quays.

The proposed development is located within Hydrometric Area No.16 (Suir). This catchment includes the area drained by the River Suir and all streams entering tidal water between Drumdowney and Cheekpoint, Co. Waterford, draining a total area of 3,542km². The largest urban centre in the catchment is Waterford City.

The River Suir is within the Suir WFD catchment. The proposed bridge is within three WFD sub-catchments:

- Blackwater [Kilmacow]_SC_010;
- Pil_SC_010; and
- Williamstown_SC_010.

10.4.2 Existing Drainage

The north quays is an area of existing hard standing that drains directly into the River Suir either through the existing drainage system or overland flow. The south quays drains to the existing storm water network which then discharges to a combined sewer running from west to east along the R680 Meagher's Quay.

10.4.3 Flood Risk

The Flood Risk at the proposed River Suir Sustainable Transport Bridge crossing has been assessed as part of this study. Previous flood studies have been undertaken as part of the PFRAMs, CFRAMS, Waterford Flood Alleviation Scheme and Waterford North Quays SDZ Planning Scheme

10.4.3.1 OPW Preliminary Flood Risk Assessment

To inform the Flood Risk Assessment (FRA), the OPW Preliminary Flood Risk Assessment (PFRA) mapping was consulted as an initial screening. As required by the EU Floods Directive, the OPW carried out a PFRA to identify areas where the risk of flooding may be significant. The PFRA is a broad scale assessment based on historic flooding, predictive analysis and consultation with local communities and experts. As part of the PFRA, maps of the country were produced showing the indicative fluvial, pluvial and tidal flood extents. Areas for Further Assessment (AFA's) were identified.

The PFRA map at the proposed bridge location indicates that the site is located within fluvial 1%AEP with coastal flood 0.5%AEP flood extents. The PFRA mapping does not indicate any pluvial or groundwater flooding within or in the vicinity of the proposed crossing. The PFRAM mapping identified Waterford City as a probable AFA.

10.4.3.2 OPW Catchment Flood Risk Assessment and Management.

Following on from the PFRA study, the OPW commissioned The South Eastern CFRAM Study Flood Risk Review which highlighted Waterford City as an AFA for fluvial and Coastal flooding. This was based on a review of historic flooding and the extents of flood risk determined during the PFRA study. The Waterford City AFA incorporates the River Suir and its associated tributaries including the Johns River as it flows through Waterford City.

The published Final CFRAM (02/08/2016) mapping indicates that the locations of the proposed north and south bridge landings have the potential to flood in 1% Fluvial AEP with 0.5% Tidal AEP flood events. The CFRAM mappings shows that the southern quays have 1% AEP flood defences. The Waterford City Flood Alleviation Scheme was constructed prior to the CFRAM publication and therefore the CFRAM mapping incorporates the benefit of the flood alleviation scheme. Calculated flood depths for the north quays are between 0-0.5m.

10.4.3.3 Waterford Flood Alleviation Scheme

Waterford City and County Council and the OPW have implemented a significant flood alleviation scheme in Waterford City. Historically Waterford City suffered recurring flooding with the River Suir and John's river experiencing out of bank events on multiple occasions in the latter half of the 20th Century. The flooding of the South Quays inundated the city's main thoroughfares and adjoining premises. The OPW and Waterford City Council commissioned consultants to undertake the Waterford City Flood Alleviation Scheme. The Scheme focused on containment of the watercourses within their channels. This was achieved through the construction of a series of flood defences in the form of reinforced concrete walls, glass walls, sheet piled walls, embankments, stormwater pumps, etc. The works were constructed in three separate civil works contracts and on completion is protecting the city from flooding from the rivers for events up to the 0.5% annual exceedance probability (1 in 200 years) in tidal areas and up to the 1% annual exceedance probability (1 in 100 years) in non-tidal areas.

The flood defences are a maximum of 1.1 - 1.2m above ground levels to preserve river views. The design heights were increased from the modelled flood heights to accommodate the effects of climate change and uncertainty in flow estimation. A freeboard of 0.5m and 0.3m was implemented in tidal and non-tidal areas respectively. The design for Waterford South Quays flood defences features glass flood defences prominently. The implemented design height for the Waterford South Quays flood defence wall is 3.7mOD.

10.4.3.4 Waterford North Quays SDZ Planning Scheme – Strategic Flood Risk Assessment

As part of the Waterford North Quays SDZ planning Scheme WCCC produced a flood risk assessment of the SDZ lands. A one-dimensional (1D) model was prepared to ascertain the effects of extreme tidal and combination tidal/fluvial events. A 1D model was utilised as it was determined that the Suir Estuary is dominated by tidal flows in the longitudinal flow direction.

The model was developed using surveyed topographic and channel cross-sections and OPW cross-sections. GSI / Marine Institute Infomar Sea bed survey data of the Waterford Harbour Area were also used to develop the model along with LiDAR data and a detailed hydrological assessment of the catchment. A medium range sea level rise scenario was adopted which is in keeping with the current OPW recommendations.

The findings from the hydraulic model were that critical flooding and flood levels in the estuary and at the location of the proposed bridge crossing are as a consequence of the tidal storm surge conditions. Fluvial flood flows at this location contribute very little to increasing the peak flood levels in the Suir. The design flood event of the scheme was a 1 % AEP fluvial & 0.5% AEP Tidal combination flood event. A minimum finished floor level of 4.42mOD was adopted as part of the final SDZ planning scheme.

10.4.4 EPA Monitoring River Programme

The EPA carries out water quality assessments of rivers, transitional and coastal water bodies as part of a nationwide monitoring programme. Data is collected from physico-chemical and biological surveys, sampling both river water and the benthic substrate (sediment).

Water sampling is carried out throughout the year and the main parameters analysed include: conductivity, pH, colour, alkalinity, hardness, dissolved oxygen, biochemical oxygen demand (BOD), ammonia, chloride, ortho-phosphate, oxidised nitrogen and temperature.

As is the case for rivers and lakes the impact of nutrient enrichment and the process of eutrophication is also a major concern in the tidal waters environment. The direct negative effects of excessive nutrient enrichment include increases in the frequency and duration of phytoplankton blooms and excessive growth of attached opportunistic macroalgae. The subsequent breakdown of this organic matter can lead to oxygen deficiency which in turn can result in the displacement or mortality of marine organisms. As such the effects of over enrichment can severely disrupt the normal functioning of tidal water ecosystems.

The status of individual estuarine and coastal water bodies is assessed using the EPA‟s Trophic Status Assessment Scheme (TSAS). This assessment is required for the Urban Waste Water Treatment Directive and Nitrates Directive. The scheme compares the compliance of individual parameters against a set of criteria indicative of trophic state (Table 10.1). These criteria fall into three different categories which broadly capture the cause effect relationship of the eutrophication process, namely nutrient enrichment, accelerated plant growth, and disturbance to the level of dissolved oxygen normally present.

Table 10.1 Biological River Water Quality Classification System

Trophic Status	Pollution Status	Condition
Unpolluted	Unpolluted	Unpolluted water bodies are those which do not breach any of the criteria in any category
Intermediate	Unpolluted	Intermediate status water bodies are those which breach one or two of the criteria

Trophic Status	Pollution Status	Condition
Potentially Eutrophic	Slightly polluted	Potentially Eutrophic water bodies are those in which criteria in two of the categories are breached and the third falls within 15 per cent of the relevant threshold value
Eutrophic	Polluted	Eutrophic water bodies are those in which criteria in each of the categories are breached, i.e. where elevated nutrient concentrations, accelerated growth of plants and undesirable water quality disturbance occur simultaneously

The River Suir at Waterford City had a EPA Transitional Surface Water Quality Status of "Eutrophic" from 2010-2012 and a Water Framework Directive (WFD) Status of "Poor" from 2010-2015. The OPW operates an improved drainage scheme within the catchment of the Suir River. The proposed development site is not within the area of this scheme and will not impact on its operation.

The WFD 'Water Matters' website mapping section provides details on the assessments of the water bodies / sub catchments in the study area. This data was reviewed as part of this assessment and a summary is given in Table 10.2.

Table 10.2 WFD Classification of Transitional Waters Near the Proposed River Suir Sustainable Transportation Bridge (2010-2015 Sampling period, EPA)

Waterbody		Code	Status	Objective	Risk	Heavily Modified Status
Upper Suir Estuary	Upstream of Waterford City	IE_SE_100_0600	Moderate	Protect	1a - At Risk	No
Middle Suir Estuary	Waterford City located within Middle Suir Estuary	IE_SE_100_0550	Poor	Restore 2021	1a - At Risk	No
Lower Suir Estuary	Downstream of Waterford City	IE_SE_100_0500	Moderate	Protect	1a - At Risk	Yes

The River Suir is given a WFD status of Poor at Waterford City and Moderate downstream. It must be noted that the WFD assessment considers the entire waterbody sub-catchment whereas the EPA monitoring results are point measurements at discrete locations. The status of the Lower Suir Estuary as a "modified water body" also changes the criteria for assessment, the amended criteria generally have higher tolerances for pollutants etc. Water quality in the catchment is mainly at risk from diffuse sources of pollution such as agriculture and on-site wastewater treatment systems. Point sources of pollution in the town of Waterford City are also highlighted as a risk to the water quality status across the wider catchment.

10.5 Potential Impact Assessment

This section will describe the impacts associated with the proposed development before mitigation measures are applied. Both direct and indirect impacts will be addressed for the construction and operation of the proposed development. The nature, extent and duration of the impacts will also be assessed.

10.5.1 Introduction

Bridge projects, given their scale and nature, have significant potential for causing impact to the hydrological environment both during its construction and operation and consequently requires careful planning and detailed assessment to ensure the best solution is obtained.

10.5.2 Methodology

The assessment of hydrological impacts for the proposed bridge development has been based on the analysis and interpretation of the data acquired during the site specific investigations undertaken as part of the EIA, including the ecological study, intrusive site investigation, material assets survey, topographical survey and hydrological walkover and surveys. The procedure follows the guidelines set out in the publication 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes', NRA (TII).

Key hydrological receptors identified in the vicinity of the bridge development include:

- The Lower River Suir SAC (European Designated Site);
- Ecologically sensitive surface water features and catchment systems; and,
- Flood Risk Areas.

10.5.3 Types of Hydrological Impact

Types of hydrological impact fall into two broad categories of quantitative and qualitative impacts.

Quantitative Impacts

Hydraulic structures such as bridges, culverts, channel diversions and outfalls can, if not appropriately designed, impact negatively on upstream water levels and downstream flows. If a bridge opening is too narrow it may impede flow during times of floods thus causing water levels upstream of the structure to be raised above what would occur in the absence of the structure.

Surface water drainage from the bridge deck and landings can lead to localised increased flows and flooding in the receiving watercourses.

Qualitative Impacts

The drainage network may convey contaminants to receiving waterbodies. The nature of the proposed development as a pedestrian, cycle and electric vehicle bridge means that the potential contaminant load and accidental spillage risk is minimal. Depending on the hydrological and ecological sensitivities of the proposed outfall receiving waters, treatment of the storm water via silt traps and petrol interceptors is required upstream of the outfall to protect the water quality, particularly from spillage and first flush events.

10.5.4 Construction Impacts

Construction activities pose a significant risk to watercourses, particularly contaminated surface water runoff from construction activities entering the watercourse.

Construction activities within and alongside surface waters associated with bridge building, can contribute to the deterioration of water quality and can physically alter the stream/river bed and bank morphology with the potential to alter erosion and deposition rates locally and downstream. Activities within or close to the watercourse channels can lead to increased turbidity through re-suspension of bed sediments and release of new sediments from earthworks. The potential impact is moderate to significant.

The main contaminants arising from construction runoff include:

- Elevated silt/sediment loading in construction site runoff. Elevated silt loading can lead to long-term damage to aquatic ecosystems by smothering spawning grounds and gravel beds and clogging the gills of fish. Increased silt load in receiving watercourses stunts aquatic plant growth, limits dissolved oxygen capacity and overall reduces the ecological quality with the most critical period associated with low flow conditions. Other pollutants in the watercourse can bind to silt which can lead to increased bioavailability of these pollutants.
- Spillage of concrete, grout and other cement based products. These cement based products are highly alkaline (releasing fine highly alkaline silt) and extremely corrosive and can result in significant impact to watercourses altering the pH, smothering the stream bed and physically damaging fish through burning and clogging of gills due to the fine silt.
- Accidental Spillage of hydrocarbons from construction plant and at storage depots / construction compounds.
- Faecal contamination arising from inadequate treatment of on-site toilets and washing facilities.

10.5.4.1 Erosion and Sediment Transport

A computational model was undertaken to assess the hydrodynamics of Suir Estuary and to assess the effects of the proposed bridge on the circulation patterns of the estuary. The hydrodynamic model was run to simulate the effect of the proposed construction works. The construction scenario simulated cofferdams in place around all the bridge piles and also the fender piles in place. This scenario significantly contracts flow through the bridge resulting in significantly increased velocity and shear stress over the existing scenario and thus giving rise to accelerated and deep scouring locally. The predicted scour depth in the channel between the cofferdams is 4 to 4.5m after a 24 day simulation with the sediment deposited locally in the channel within 150m upstream and 300m downstream. The potential impact is moderate to significant.

10.5.4.2 Impact on Flooding

The volumes displaced by the proposed bridge piers, abutments and cofferdams during construction phase is extremely small relative to the volumes of the receiving waterbodies and will result in a slight to imperceptible impact.

The existing flood defences on the south quays will have to be removed to allow for the integration of the bridge abutment. There is potential for inundation at this location during the construction period without the implementation of mitigation measures. Two sections of flood wall east and west of the proposed bridge will be removed to provide access to the new jetties, these will be replaced with flood gates. The potential impact is moderate to significant.

10.5.5 Operational Impacts

Bridge crossing may cause permanent disturbance of rivers and floodplains may occur at bridge abutments and where they connect to the bank. These structures can, if not appropriately designed, create an obstacle to flow, particularly under flood conditions resulting in increased flood risk and damage as a result of afflux by such structures. Such structures can locally alter bed levels and channel dimension resulting in changes in flow velocity and water depth which can, during low flow periods, represent a barrier to fish passage. These structures can result in localised bed and bank erosion, resulting in long-term changes to the morphology of the stream channel.

10.5.5.1 Erosion and Sediment Transport

The hydrodynamic model was run to simulate the effect of the proposed bridge crossing. Under the proposed bridge scenario, silt is eroded and transported in suspension with the tidal flows (similar to the existing scenario) and is well mixed and distributed through-out the downstream reach forming part of the natural dynamic suspended sediment load in the estuary. The simulation indicates that the proposed bridge results in localised erosion at the structure principally away from the piles with the deposition of the eroded material occurring local to the site both upstream and downstream of the bridge. The extent of deposition from the scouring is located within 150m upstream of the bridge and 300m downstream. The scour depth at the bridge after a 24day simulation period is 1.5m and it likely to double to 3m over time after which an armouring layer of the heavier fractions left behind will prevent further scouring of the channel at the bridge. The deposited sandy sediments is likely to slowly migrate downstream becoming more distributed spatially with distance downstream.

The hydrodynamic modelling indicates that erosion and deposition of the river bed will remain local to bridge structure (within 150m upstream of the bridge and 300m downstream. The long term vertical alteration to the bed elevation (3m scour depth) is less than the existing bed undulations, depths in the main channel of the Suir through Waterford City (bed elevations range from -8 to -24mOD). The potential impact is therefore rated as slight.

10.5.5.2 Impact on Flooding

The design for the proposed bridge structures will have capacity to convey the 1 % AEP fluvial & 0.5% AEP Tidal combination flood event with appropriate allowances for statistical error and climate change as per the OPW requirement and in-line with TII guidelines. Hydraulic flood modelling was carried out to estimate the design flood level and potential impact of the proposed bridge development. In this respect, the design flow and flood levels are based on the Index Flood Estimate (Qmed) using Flood Studies Update (FSU) Estimation Method and Tidal Gauge flood level analysis.

The FSU Research Programme was implemented by the OPW and provides a substantial update of the FSR. The FSU is an upgraded method for providing estimates at a network of hydrometric nodes throughout Ireland and has a factorial error of 1.38. The method uses a pooled growth curve of hydraulically similar catchments as the subject catchment which differs from the FSR which uses a single national growth curve.

A water level gauging station is present directly downstream of the proposed bridge crossing at Adephi Quay (no. 16160). A short continuous water level record is available from 1999 to 2015 (a 17-year annual maxima series). The median water level at the Adelphi Quay hydrometric gauge was 2.58 mOD in 2018 and highest recorded water level was 2.89 mOD which occurred on the 27th October 2004.

A hydraulic model was run for the existing scenario and also including the proposed bridge development. For all simulations the impact on flood levels both locally upstream and downstream were found to be extremely small and less than the modelling tolerance of 4mm. Details of the modelled flood levels at the proposed crossing and the corresponding proposed structure soffit level are given in Table 10.3 below.

A section of the existing flood defences on the south quays will be altered at the southern abutment and two smaller sections replaced with flood gates to provide access to the new jettys. The bridge deck merges with the south quays landing at a level of 4.2mOD. This is 0.5m higher than the existing flood defence level on the south quays, thus maintaining the existing standard of protection. The potential impact is slight.

Table 10.3 Predicted design flood levels at the proposed River Suir crossing (1 % AEP fluvial & 0.5% AEP Tidal combination flood event)

River/Stream Name	Proposed Soffit Levels (mOD)	Design Flood Level (mOD)
Suir	North quay: +6.579 South quay: +3.754	4.42*

**Includes OPW Mid-range Future Scenario (MRFS) allowance for climate change*

10.5.5.3 Predicted Impact of Storm Discharge on Flooding / Morphology

The existing drainage pathways for the north and south quays will be maintained as part of the development during operation. The interception of rainfall by the bridge deck will lead to an imperceptible reduction in runoff to the River Suir. The potential impact is imperceptible.

10.5.5.4 Predicted impact of Storm Discharge of pollutants

Salt and grit applications to trafficked surfaces to mitigate icy conditions will result in an increased salinity, pH, conductivity and total dissolved solids concentrations to receiving aquatic system. Increased salinity of watercourses can alter the ecological balance of the aquatic system and increase the bioavailability of chemical contaminants. It is anticipated that the use of salts and grits will be minimal due to the light trafficking of the bridge.

The south quays plaza and the southern half of the bridge will drain to the existing surface water drainage system. This is treated at the Waterford City Water Treatment Plant before discharge to the River Suir.

Prior to the completion of the north quays SDZ development the northern half of the bridge will drain to the river Suir as it does naturally. The bridge will not be in use prior to the completion of the SDZ development with no deposition of pollutants occurring and therefore resulting in an imperceptible impact.

On completion of the SDZ development the north section of the bridge will discharge to the North Quays surface water drainage network, this will incorporate pollution control measures including silt traps, petrol interceptors and SuDS components treating all runoff prior to discharging to the River Suir. The potential impact is slight to imperceptible.

10.5.5.5 Water Quality Impact - Accidental Spillage Risk Assessment

The risk of pollution to both surface and groundwater resulting from accidental spillage is an issue considered in the development to be negligible. The bridge traffic is limited to pedestrians and an electric shuttle bus. It is not anticipated that any chemicals or hydrocarbons will ever be transported across this bridge. Therefore, it is not anticipated that the risk of spillage will occur. There was therefore no spillage risk identified as part of the spillage risk assessment.

10.6 Mitigation & Monitoring Measures

10.6.1 Construction Mitigation

As is normal practice with road infrastructure projects, an outline Environmental Operating Plan (EOP) has been prepared for the River Suir Sustainable Transportation Bridge and is included in Appendix 4.1. The following will be implemented as part of this plan:

- An outline Incident Response Plan (see Appendix 4.1 A) detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance incident with any permit of license or other such risks that could lead to a pollution incident, including flood risks.
- All necessary permits and licenses for in stream construction work for provision of the bridge and landings will be obtained prior to commencement of construction.
- Inform and consult with IFI and WI.
- Implement the Outline EOP contained in Appendix 4.1 of this EIAR.

An outline EOP has been developed and is provided in Appendix 4.1 of this EIAR. These will be developed by the selected construction contractor to suit the detailed construction methodology and allocate responsibilities to individuals in the construction team. In doing so, the measures detailed in the appended reports will be considered minimum requirements to be considered and improved upon. The level of detail provided within the current drafts of the Plans is sufficient to allow an assessment of the anticipated impacts including residual impacts.

During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water.

- Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board)
- Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers.
- CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors.
- CIRIA C648 Control of Water Pollution from Constructional Sites.
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA/TII, 2006).

Based on the above guidance documents concerning control of constructional impacts on the water environment, the following outlines the construction phasing and the principal mitigation measures that will be prescribed for the construction phase in order to protect all catchment, watercourse and ecologically protected areas from direct and indirect impacts:

- Stage 1 – Site Setup and Clearance
- Stage 2 – Complete South Quays Excavation and Piling
- Stage 3 – Installation of Cofferdams and Temporary/Permanent Piles
- Stage 4 – Reinforced Concrete Pier and Temporary Works Construction
- Stage 5 – Land Central Deck Sections
- Stage 6 – Land End and Opening Spans

Proposed General Mitigation Measures

- Site works will be limited to the minimum required to undertake the necessary elements of the project;
- As far as is practicable, construction works shall proceed within predetermined Construction Areas on a phased basis. These areas will be determined by the contractor during the construction phase of the project;
- Surface water flowing onto the construction area will be minimised through the provision of berms, diversion channels or cut-off ditches;
- Management of excess material stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be undertaken. This may involve allowing the establishment of vegetation on the exposed soil and the diversion of runoff water from these stockpiles to the construction settlement ponds;
- Protection of waterbodies from silt load will be carried out through use of timber fencing with silt fences or earthen berms to provide adequate treatment of runoff to watercourses;
- Settlement ponds, silt traps and bunds will be used. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap;
- The anticipated site compound/storage facility on the South Quays will be fenced off at a minimum distance of 10m from the top of the edge of the quay/river egde. Any works within the 10m buffer zone will require measures to be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the watercourse. See the outline EOP and outline Construction Environmental Management Plan (CEMP) in Appendix 4.1 and 4.1 B of this EIAR.
- Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with the NRA/TII document "Guidelines for the crossing of watercourses during the construction of National Road Schemes". All chemical and fuel filling locations will be contained within bunded areas and set back a minimum of 20m from watercourses.
- Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution;
- The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses; and
- Water quality monitoring will be undertaken in the River Suir, with monthly samples being taken from at least 6 months prior to commencement of construction until at least 24 months post-completion. Water samples will be taken from at least two locations. The final number and location of sampling points will be determined by the Site Environmental Manager. The results of the water quality monitoring programme will be reviewed by the Site Environmental Manager and Ecological Clerk of Works on an ongoing basis

during construction. In the event of any non-compliance with regulatory limits for any of the water quality parameters monitored, an investigation will be undertaken to identify the source of this non-compliance and corrective action will be taken where the this is deemed to be associated with the proposed development.

Specific Mitigation Measures - Concrete Works

The bridge piers and abutment construction will require the pouring of concrete within cofferdams in the River. The use and management of concrete in or close to watercourses must be carefully controlled to avoid spillage which has a deleterious effect on water chemistry and aquatic habitats and species. As the use of concrete cannot be avoided the following control measures will be employed:

- Hydrophilic grout and quick-setting mixes or rapid hardener additives shall be used to promote the early set of concrete surfaces exposed to water;
- When working in or near the surface water and the application of in-situ materials cannot be avoided, the use of alternative materials such as biodegradable shutter oils shall be used;
- Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters;
- Placing of concrete in or near watercourses will be carried out only under the supervision of the Ecological Clerk of Works (ECoW);
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials. Such spills shall be contained immediately and runoff prevented from entering the watercourse;
- Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses and lakes;
- On-site concrete batching and mixing activities will only be allowed at the identified construction compound areas;
- Washout from concrete lorries, with the exception of the chute, will not be permitted on site and will only take place at the construction compound (or other appropriate facility designated by the manufacturer);
- Chute washout will be carried out at designated locations only. These locations will be signposted. The Concrete Plant and all Delivery Drivers will be informed of their location with the order information and on arrival to site; and
- Chute washout locations will be provided with an appropriate designated, contained impermeable area and treatment facilities including adequately sized settlement tanks. The clear water from the settlement tanks shall be pH corrected prior to discharge (which shall be by means of one of the construction stage settlement facilities) or alternatively disposed of as waste in accordance with the Contractor's Waste Management Plan.

10.6.2 Erosion and Sediment Transport

It is recommended given the depth of scouring estimated during the construction phase as part of the hydrodynamic modelling that cofferdams around the support pile sites should be phased where possible of the time that both are in place simultaneously minimised to limit the degree of contraction and reduce scouring during construction.

10.6.3 Flooding

The volumes displaced by the proposed bridge piers, abutments and cofferdams during construction phase is extremely small relative to the volumes of the receiving waterbodies and will result in an imperceptible.

The existing flood defences on the south quays will have to be removed to allow for the integration of the bridge abutment. Tide level and weather forecasts shall be monitored for potential flood events. Temporary flood defences shall be provided during construction at this location to maintain the south quays flood defences to a level of 3.7mOD.

10.6.4 General Operational Mitigation

All potential impacts have been identified as imperceptible to slight in the operational phase and as such no long-term mitigation measures are proposed.

10.7 Residual Impacts

The residual hydrological impacts associated with the River Suir Sustainable Transportation Bridge can be grouped as follows:

- Construction phase;
- Flood Risk; and
- Erosion and Sediment Transport

10.7.1 Construction phase

Construction shall be undertaken in accordance with the measures outlined in the Environmental Operation Plan in Appendix 4.1 of this EIAR. There will therefore be a slight residual impact during the construction of the River Suir Sustainable Transportation Bridge.

10.7.2 Flood Risk

No negative residual impacts on flood risk due to loss of conveyance or storage are anticipated at the river crossing. The design for the River Suir Sustainable Transportation Bridge is considered to be conservative and therefore avoids any conveyance capacity issues. The recommended mitigation measures will negate potential risk of flooding at the north and south quays.

10.7.3 Erosion and Sediment Transport

The effect of the proposed bridge on the erosion and sediment regime will be small and highly localised, the effective change in scour patterns will be insignificant in comparison to the existing erosion and sediment transport patterns. The residual impact to surface water morphology is anticipated to be slight as all practicable mitigation measures are to be implemented.

10.8 Difficulties Encountered

There were no difficulties associated with this assessment.

10.9 References

Geological Survey of Ireland Groundwater Data Viewer (2017)

Geological Survey of Ireland (GSI) – Bedrock Geology;
Teagasc – Subsoil Map;

Environmental Protection Agency Envision (2017) WFD Status

Environmental Protection Agency Envision (2017) Surface Water Quality

Irish Coastal Strategy Study Phase 2 – South East Coast – Work Packages 2, 3 & 4A – Technical Report (OPW, 2010)

Appendix 10.1
Hydrodynamic Modelling Report

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Report No. HEL212202 v1.1

Hydraulic Modelling of Proposed River Suir Sustainable Transport Bridge

Prepared for

Roughan O'Donovan Consulting Engineers

October 2018

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Hydraulic Modelling of Proposed River Suir Sustainable Transport Bridge

Job No.:	212202
Report No.:	HEL0212202 v1.1
Prepared by:	Anthony Cawley BE, MEngSc, CEng MIEI
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DISCLAIMER

This hydraulic modelling report has been prepared for Roughan O'Donovan Consulting Engineers as input to the River Suir Sustainable Transport Bridge Design Project. Hydro Environmental Ltd. accept no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned.

CONTENTS

1. INTRODUCTION

1.1 Background

Hydro Environmental Ltd., in association with Aquafact International Ltd., was commissioned by Roughan O'Donovan Consulting Engineers to carry out hydrodynamic modelling study of the proposed River Suir Sustainable Transport Bridge in Waterford in support of the preliminary design and input to the Hydrology chapter of the Environmental Impact Assessment Report (EIAR) and the Natura Impact Statement (NIS). The purpose of this study is to predict the potential change in flow velocities within the Suir Estuary and to assess the impact of the proposed development on bed morphology as a result of changes to the sediment transport regime.

1.2 Description of Proposed development

The proposed development aims to create a new pedestrian, cycle and electric vehicle crossing over the Suir Estuary to link the North Quays and the Strategic Development Zone (SDZ) to the South Quays and its commercial and shopping area in Waterford City centre. The proposed bridge crossing is located approximately 550m downstream of Edmund Rice Bridge (R680). Edmund Rice Bridge itself is of relatively recent construction (1986) with the central section being a movable vertical lift bridge for facilitating vessel navigation up and down the estuary. Historically a bridge crossing has existed at the Rice Bridge location since 1794 (Wooden (Timbertoes) Bridge (1794), John Redmond Bridge in 1913).

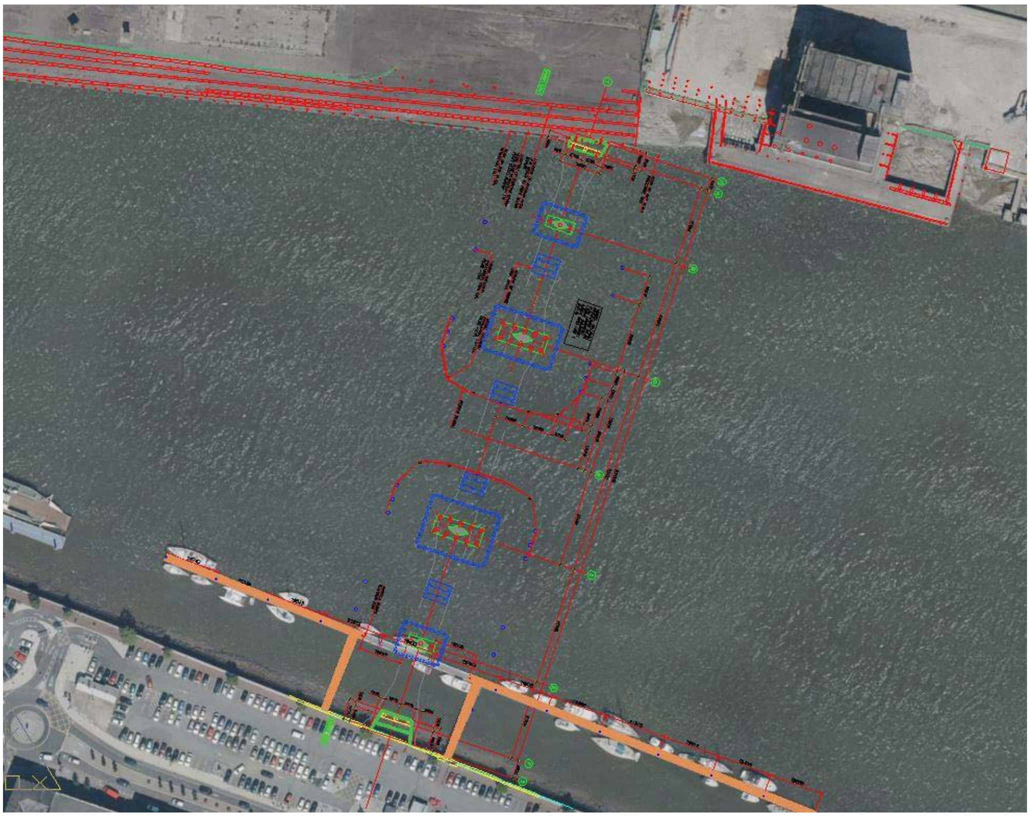


Figure 1 Proposed Bridge Crossing of Suir Estuary between North and South Quays in Waterford City

The proposed bridge will span a 207m width of the estuary with a movable central navigation section. The bridge will be formed on a series of 1200mm diameter piles supporting large concrete abutments and concrete piers (4 no concrete piers with spans of 27.5m, 41m, 70m, 41m and 27.5m). The base of the concrete piers will terminate at -5.4m OD and below this large 1200mm diameter pile columns extend down to bedrock. The bed level at the bridge crossing is typically at -9.5 to -11.5m O.D. and the bedrock level at the central piers is -18m to -26m OD falling from north to south, based on the ground investigations (GI). The supporting piles are driven to bedrock and a rock socket formed with the bedrock. A piled fender system (750mm diameter piles) will be provided to protect the bridge piers from vessel collision. This fender system will be on both sides of the navigation channel so as to protect the lift bridge section from damage. In the navigation section between the piled fenders a 25m open width is provided for vessel passage. Refer to Figure 2 below for cross-section details.

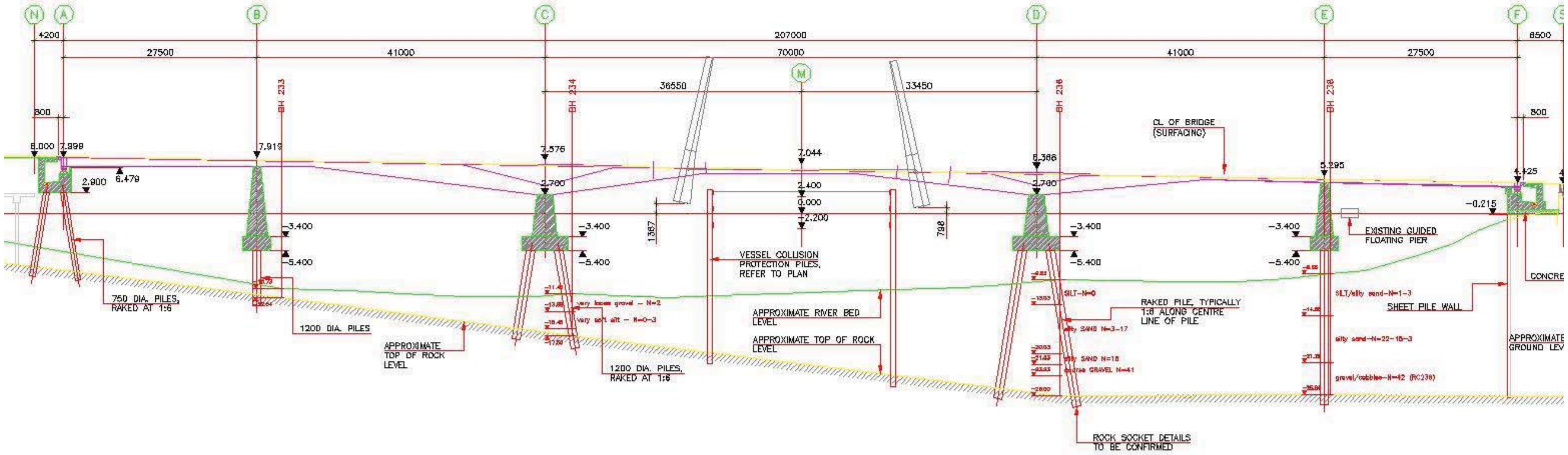


Figure 2 Section of Proposed Bridge showing the piled abutments and the four piled piers, anti-collision fenders and the vertical lift section.

1.3 Results of Ground Investigation

Ground investigation was carried out by IGSL for the proposed development between June and October 2017. A number of overwater boreholes were drilled (7 No.) at various locations across the estuary width at proposed bridge locations to establish the characteristics of the overburden (in terms of sediment distribution, overburden depth, bearing capacity, etc.), top of rock and characteristics of the bedrock. The borehole locations were selected to coincide with the location of the support points for the proposed bridge. The overwater drilling involved 7 No. cable percussive boring to refusal and 7 no. rotary cores. APEX Geoservices carried out an overwater geophysical survey along the footprint of the proposed bridge. The objectives of the geophysical investigation were to map variation in sediment type and thickness, determine depth to bedrock, estimate the mass characteristics of the rock and assess possible buried features.

The bed sediments based on the ground investigation indicate a variable bed sediment with overburden depths increasing from c. 7m to over 20m north to south.

The depth to top of rock increases from across the river from north to south with elevations of top of rock at -7m OD at rotary core RC232, -11.5m OD at RC233, increasing to c. -18m OD at RC234 and RC 235 and increasing to c. -26m OD at RC236, 237 and 238. The underlying bedrock is shale. The sediment sampling indicated varying layers of sandy gravelly silt to silty sand and gravel with the sediments being more silty to the south. Typically, the sediments returned had 30 to 40% silt, 30 to 40% sand and 20 to 30% gravel and cobbles. Aquafact, as part of the hydrometric survey, carried out bed surface grab sampling which showed the bed surface to be predominantly a medium to coarse sand with some gravel and a relatively low silt/clay content, as presented in Tables 1.1 and 1.2.

Table 1.1 Results from Sediment Sampling

Stn	>8mm	Gravel (4-8)	Gravel (2-4)	Very Coarse Sand (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Very Fine Sand (%)	Silt-Clay
W1	0	45.5	15.3	11.2	11.4	11.5	2.3	2.1	0.6
W2	0	0.1	0.1	1.9	32.6	32.7	7.2	20.2	5.1
W3	0	4.3	3.1	8.4	25.7	24.6	8.4	14.1	11.3
W4	0	15	4.9	5.6	13.2	51.7	4.4	4	1.2
W5	0	0.4	0.2	0.6	5.4	89	2.4	1.7	0.2

Table 1.2 Results from Sediment Sampling

Station	Gravel	Sand	Mud	Sand:Mud	Sand % (of Sand + Mud)
W1	60.8	38.5	0.6	64.17	98.47
W2	0.2	94.6	5.1	18.55	94.88
W3	7.4	81.2	11.3	7.19	87.78
W4	19.9	78.9	1.2	65.75	98.50
W5	0.6	99.1	0.2	495.50	99.80

2. HYDRAULIC MODEL DESCRIPTION

2.1 General

In order to assess accurately the potential impact of the proposed bridge crossing with its many in-stream piled bridge supports and its piled fender collision protection, a high resolution 2-D hydrodynamic model of the local reach was required so as to model the complex 2-D flow field around the supports. To efficiently drive this high resolution 2-D model a 1D node-link river estuary model was required, which extended from southern open sea upstream to the tidal extents on the Suir, Nore and Barrow Rivers, as presented in Figure 3. This enabled the large tidal flows generated within each of the estuaries to be computed under varying tides and fluvial inflows and appropriately specified as boundary conditions to the local “-D model Reach.

2.2 HEC-RAS 1-D model

A 1D river model using HEC-RAS hydraulic software system developed by the U.S. Army Corps of Engineers was used to model Waterford Harbour and its full estuarine reaches of the Suir, Barrow and Nore Rivers. HEC-RAS is the industry standard used internationally for hydraulic modelling of river and estuarine systems. HEC-RAS implements a 1-dimensional model of longitudinal channel flow (depth and width averaged) and solves for water elevation and average cross-sectional velocity under unsteady flows solving the full St. Venant equations that include the momentum and mass equations. HEC-RAS 1-D is ideal for modelling narrow elongated estuaries where the dominant flow is longitudinal with little variation in the energy slope in the transverse direction.

The unsteady model allows for tidal varying flow and elevation boundary conditions to be specified at the downstream Open Sea boundary and inflow hydrographs at the upstream fluvial boundaries. It also facilitates internal inflows at various nodes to allow for inclusion of lateral tributary inflows. The HEC-RAS model requires cross section survey data of bed and overbank levels versus Station distance from left overbank to right overbank and facilitates different channel roughnesses and various structure types including bridges, culverts spillways and weirs.

2.3 TELEMAC Hydraulic Software System

The TELEMAC system is the software of choice for modelling the complicated hydrodynamics of the Suir Estuary at the bridge crossing, particularly given the very high computation refinement required to model the individual slender piles for the proposed bridge structure and the collision fender system. TELEMAC is a software system designed to study environmental processes in free surface transient flows. It is therefore applicable to seas and coastal domains, estuaries, rivers and lakes. Its main fields of application are in hydrodynamics, water quality, sedimentology and water waves.

TELEMAC is an integrated, user friendly software system for free surface waters. TELEMAC was originally developed by Laboratoire National d'Hydraulique of the French Electricity Board (EDF-LNHE), Paris. It is now under the directorship of a consortium of organisations including EDF-LNHE, HR Wallingford, SOGREAH, BAW and CETMEF. It is regarded as one of the leading software packages for free surface water hydraulic applications and with more than 1000 Telemac Installations Worldwide.

The TELEMAC system is a powerful integrated modelling tool for use in the field of free-surface flows. Having been used in the context of very many studies throughout the world (several thousand to date), it has become one of the major standards in its field. The various simulation modules use high-capacity algorithms based on the finite-element method. Space is discretised in the form of an unstructured grid of triangular elements, which means that it can be refined particularly in areas of special interest. This avoids the need for systematic use of embedded models, as is the case with the finite-difference method. Telemac-2D is a two-dimensional computational code describing the horizontal velocities, water depth and free surface over space and time. In addition it solves the transport of several tracers which can be grouped into two categories, active and passive, with salinity and temperature being the active tracers which alter density and thus the hydrodynamics.

The TELEMAC System is a set of finite element programs designed to solve free water surface problems. A series of modules are available for solution of hydrodynamics, transport and dispersion of pollutants, sediment transport and wave dynamics. These are:

- TELEMAC-2D: 2-dimensional depth averaged hydrodynamics and transport and dispersion of tracers

- TELEMAC-3D: 3-dimensional hydrodynamics, transport and dispersion and sediment movement

- TOMAWAC: A third generation spectral wave model representing the generation of waves due to winds or offshore climates and propagation into shallow waters.

- ARTEMIS: A harbor wave model that solves the mild slope equation in elliptical form and includes the processes of refraction by bed shoaling, wave breaking, diffraction and reflection of waves due to structures.

- SISYPHE: Sediment transport module solving bed and suspended load of cohesive and non-cohesive sediments and can be coupled with TELEMAC-2D, -3D and TOMAWAC for the hydrodynamic transport and bed shear stress calculations

Each TELEMAC Module uses a completely flexible unstructured mesh of triangular elements allowing it to efficiently model complex geometry problems such as harbours and estuaries.

2.4 Data Sources

A range of survey information was utilised in constructing the 1D and 2D models which are described below:

- OPW CFRAM river cross-section survey of the Suir, Nore and Barrow river channels
- Apex cross-sections River Survey of the Suir at Waterford
- Infomar Sea bed Survey of Waterford Harbour
- Admiralty Chart of Waterford Harbour
- Apex Topographical Survey of the SDZ site and adjacent lands
- 2m Lidar Survey of Waterford City
- High resolution bathymetric Survey of the immediate area at the footbridge
- GI Borehole cores and sediment distribution analysis at the Footbridge crossing
- Bed sediment sampling by Aquafact at the bridge crossing
- ADCP (Acoustic Doppler Current Profiler) current metering over a 24day period at 1m vertical Bin depths by Aquafact

2.5 1-D Model Development

River channel and overbanks were defined for approximately 115km of river reach along the main river/estuarine channels of the Suir, Nore and Barrow. The complete estuarine reaches which extend many kilometres upstream along the Suir, Barrow and Nore were included in the model so that the simulations accurately accounted for the large tidal exchange volume that generate significant ebbing and flooding flows at Waterford Harbour. The model domain is presented in Figure 3 and the HEC-RAS model schematic in Figure 4.

The model domain extends from the open sea off Dunmore to 1km upstream of Carrick-On-Suir on the Suir, to 3km north of St. Mullin's Village on the River Barrow and to Inistoige on the Nore. A total of 249 river sections were included from the various surveys. Survey information was not available for a 19km upstream middle section of the Suir Estuary from Woodstown, Waterford to Piltown, southeast of Carrick-on-Suir. This unavailable (un-surveyed) reach was represented by simple liner interpolation between the nearest available upstream and downstream surveyed section so as to account for the tidal exchange volume.

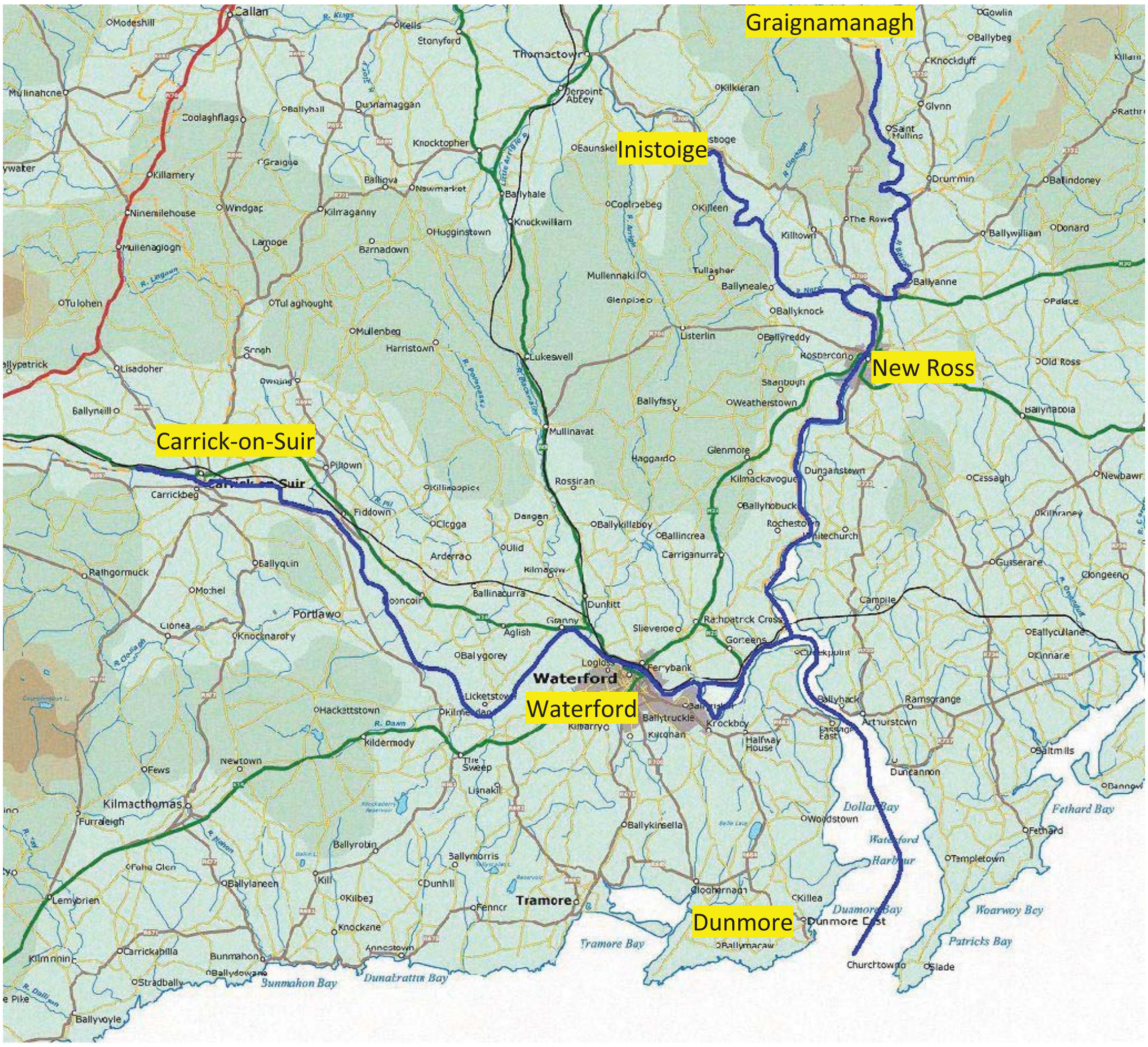


Figure 3 Extent of Waterford Harbour Estuarine Model

A Manning's roughness coefficient (n) of 0.028 was used for the various estuarine reaches and a lower roughness coefficient of 0.024 for the wider and deeper Waterford Harbour reach. These roughness coefficients are considered to be appropriate for the wide deep estuarine reaches through Waterford.

The model set-up included the loop configuration around King's island in Waterford Harbour. The draw bridge structure at Rice Bridge is located immediately upstream of the SDZ lands.

The survey section included the flood protection along the South Quays and the modelled river channel overbank sections extended through the SDZ lands along the north bank. The estuarine sections off Dunmore East are over 4km wide, whereas the estuarine sections near Cheekpoint were c. 800m wide and c. 220m, adjacent to the SDZ Lands.

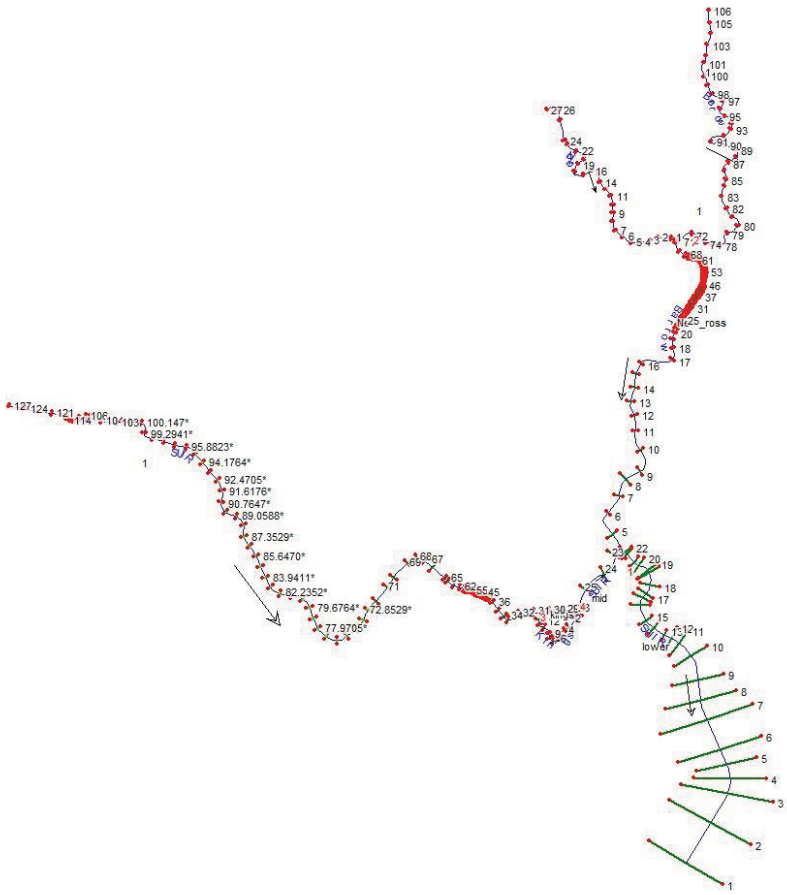


Figure 4 HEC-RAS Model Schematic

2.6 2-D Model Development

The 2-D model domain area is presented in Figure 5 which represents the local estuarine reach at Waterford City, some 5.13km in length and 102.1ha in area.

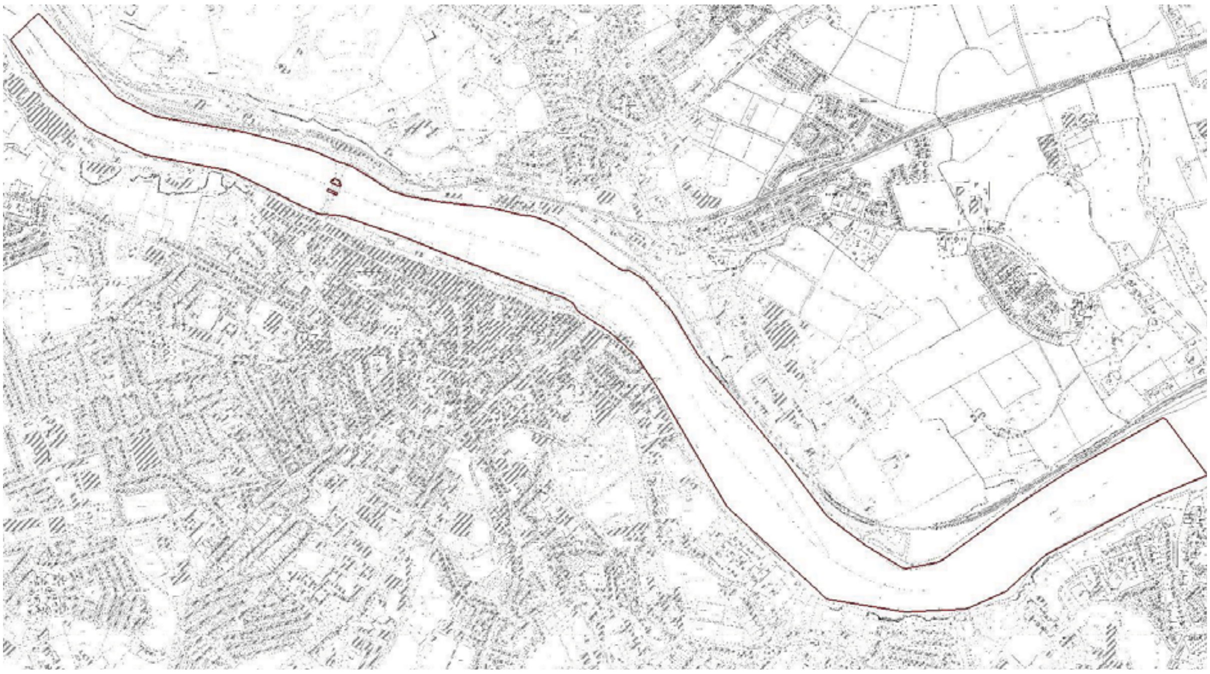


Figure 5 2-D Model Reach of Suir Estuary at Waterford City

Figure 6 Bathymetric Survey data coverage for Study Reach in vicinity of proposed Bridge crossing

Figure 7 Modelled Bathymetry

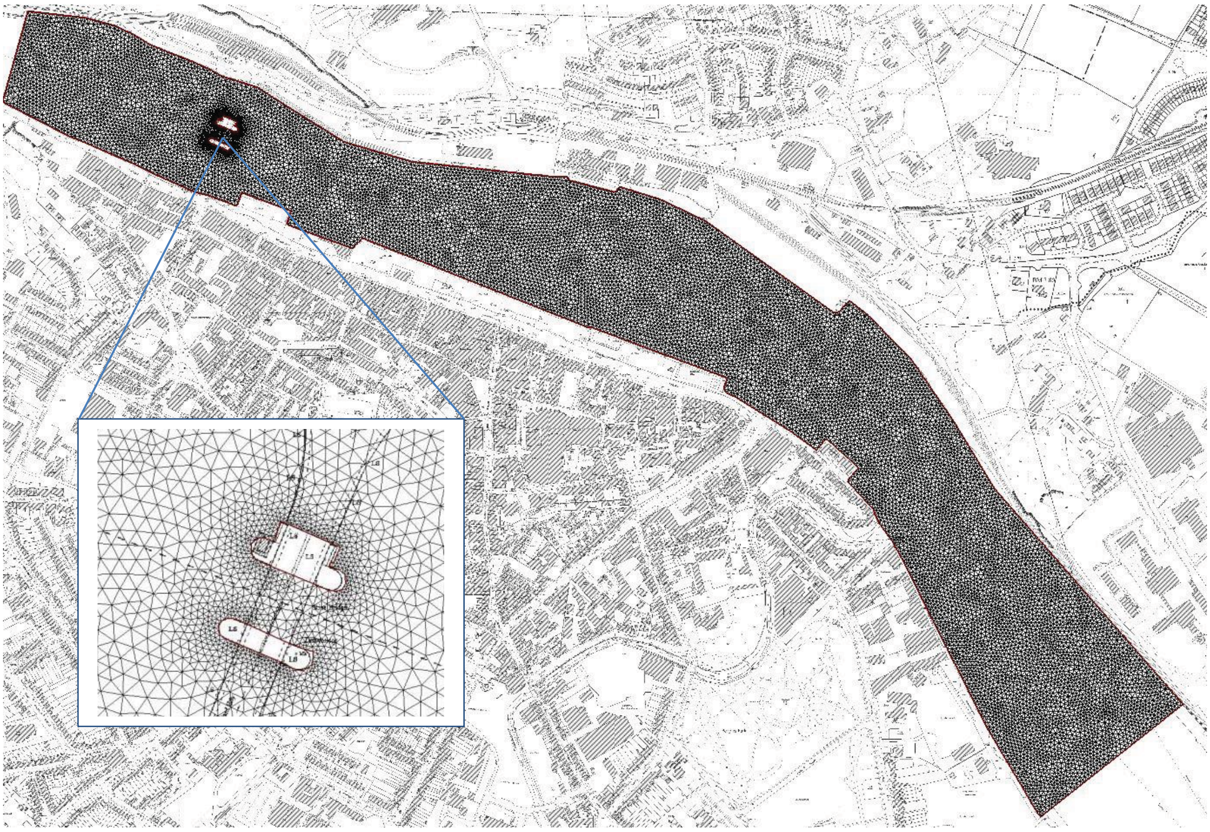


Figure 9 Finite Element Mesh for existing scenario

2.7 Model Calibration

The hydrodynamic model was calibrated against the tidal velocity and elevation measurements performed by Aquafact using an Acoustic Doppler Current meter for the period 25th June 2018 to 19th July 2018. The ADCP was deployed for

24days at the proposed bridge crossing section, located 42m out from the North Quay, National Grid Reference 260782, 112796 (refer to Figure 8).

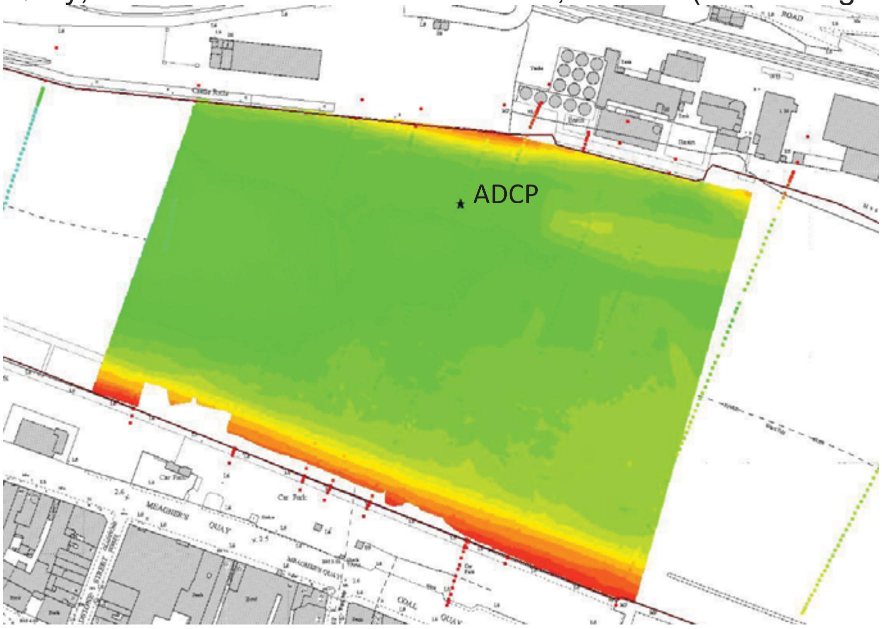
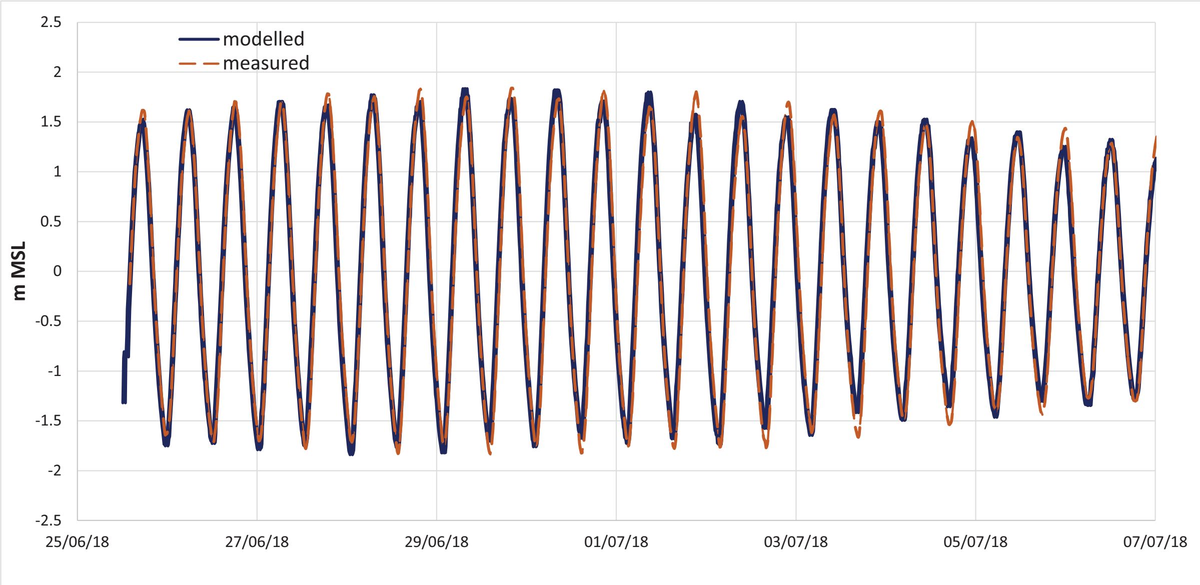


Figure 8 Location of ADCP current meter for model calibration.

The tide elevation recorded at Dumore East tidal gauge was input to the 1D HEC-RAS model and the model was run for the 24day simulation period so as to produce flow and elevation hydrographs at the upstream and downstream locations.

The hydrodynamic model was run for a start date of 25/06/2018 14:00 to the 19/07/2018 12:00 for a computational time step of 1second and simulation results were output every 10 minutes for the complete model domain and stored in a binary results database. Time series of tide elevation and depth averaged velocities were generated for the measurement point from this results database. A final calibrated Manning's roughness of 0.028 was used with a full k-ε turbulence model to simulate eddy viscosity / turbulence and accurately produce the observed hydrodynamics.



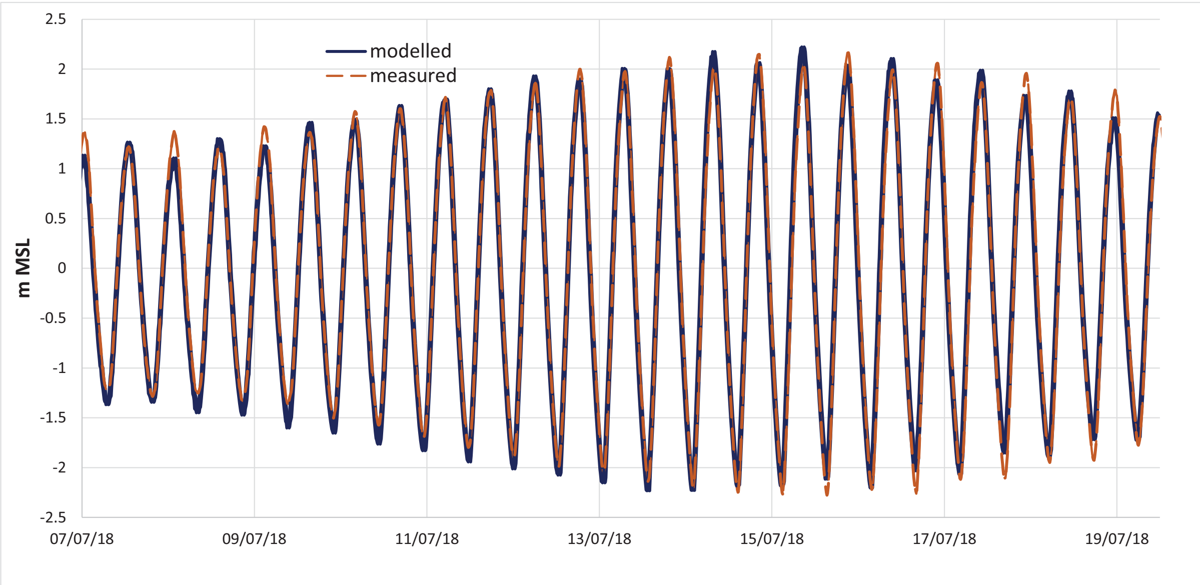


Figure 9 Measured and Predicted Tidal Elevation 25 June 2018 to 19 Jul 2018

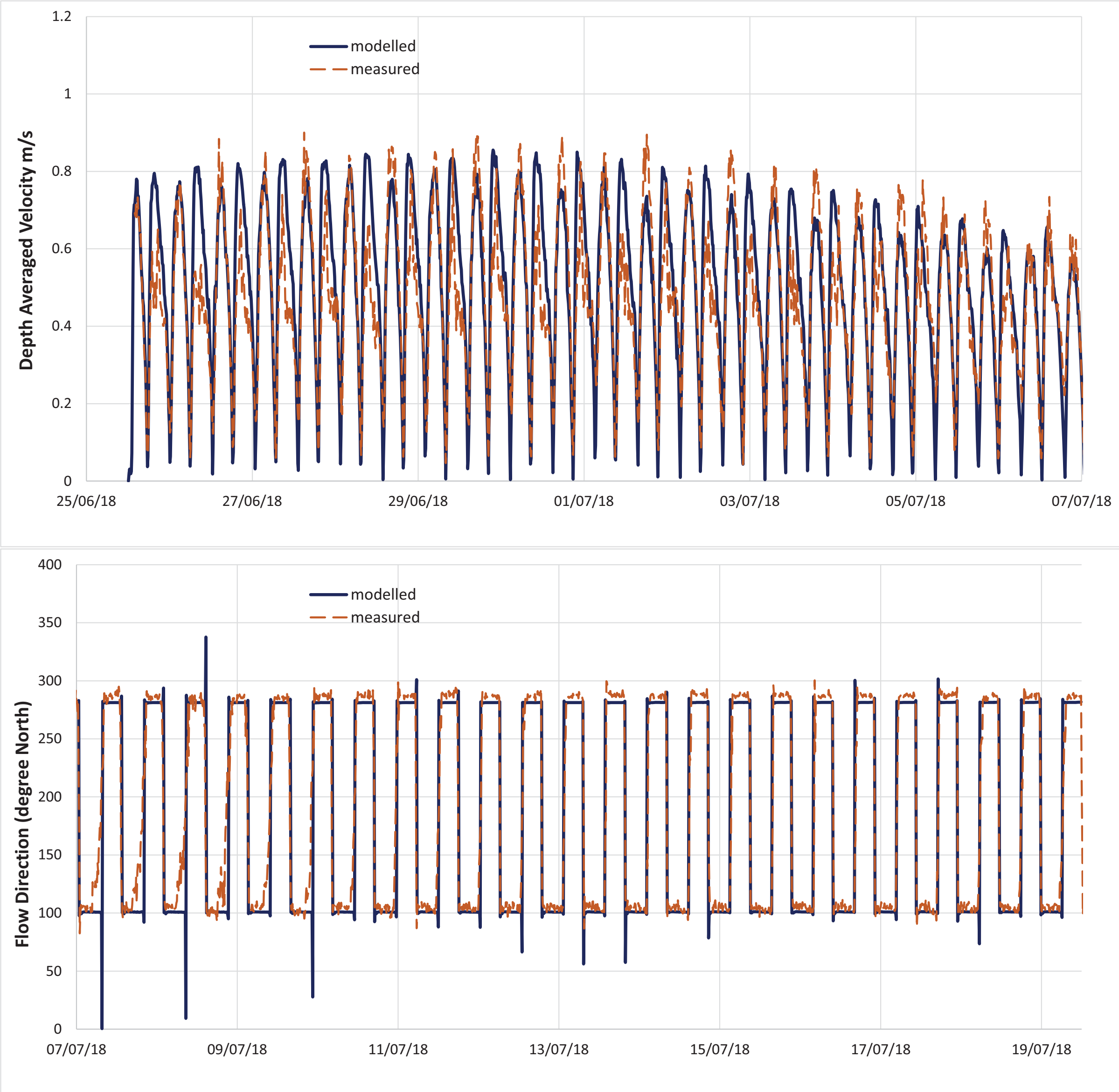


Figure 10 Measured and Modelled Depth Averaged Velocity Magnitude and Direction 26 June 2018 to 7 July 2008

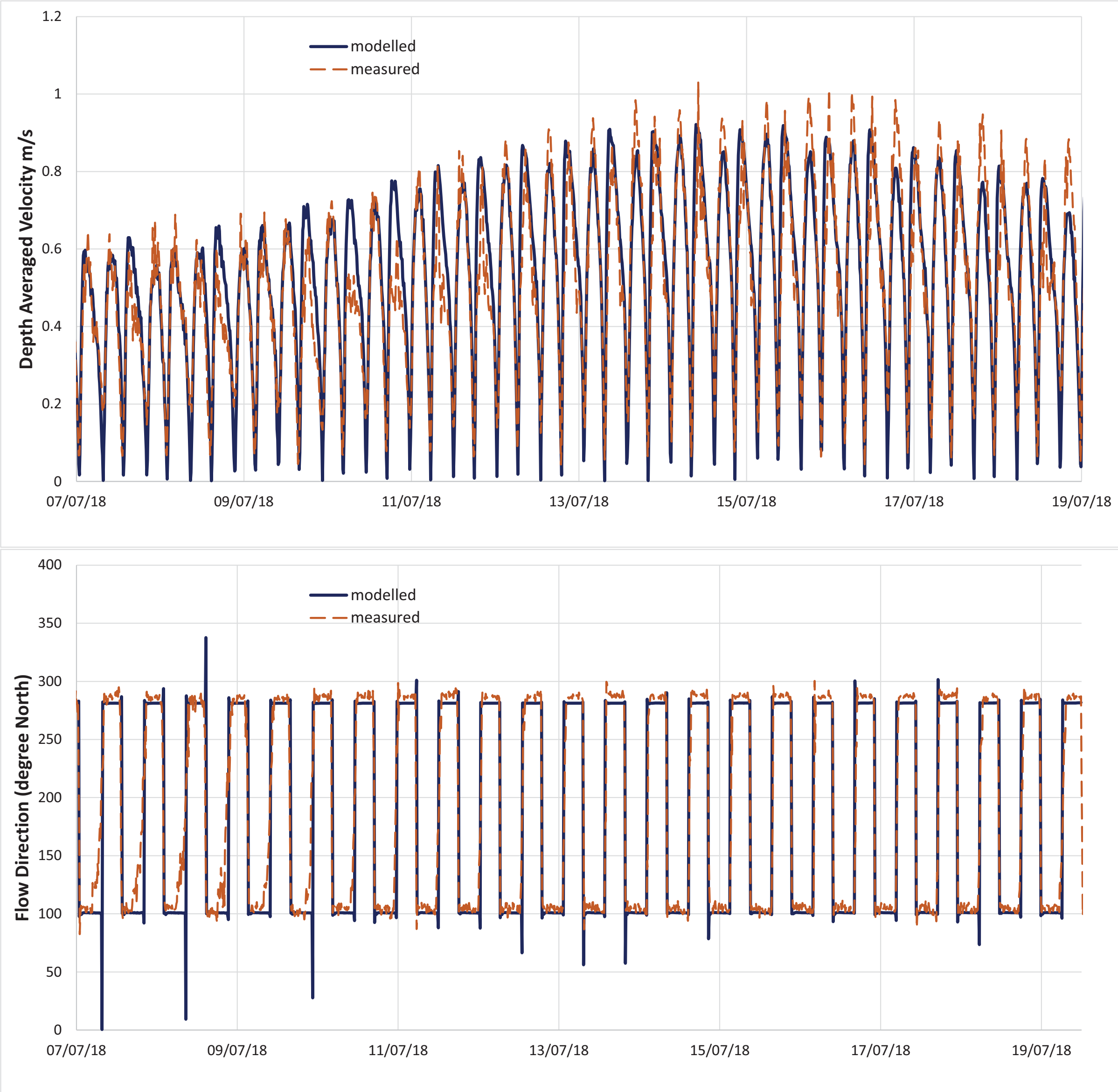


Figure 11 Measured and Modelled Depth Averaged Velocity Magnitude and Direction 7 July 2008 to 19 July 2008

2.8 Proposed Bridge Finite Element Model

For the same model reach extent as the existing model, a finite element mesh was generated modelling the support piles at the bed and also modelling, as a very conservative case the in-stream construction sheet piling at all of the pier sites, refer to Figure 13.

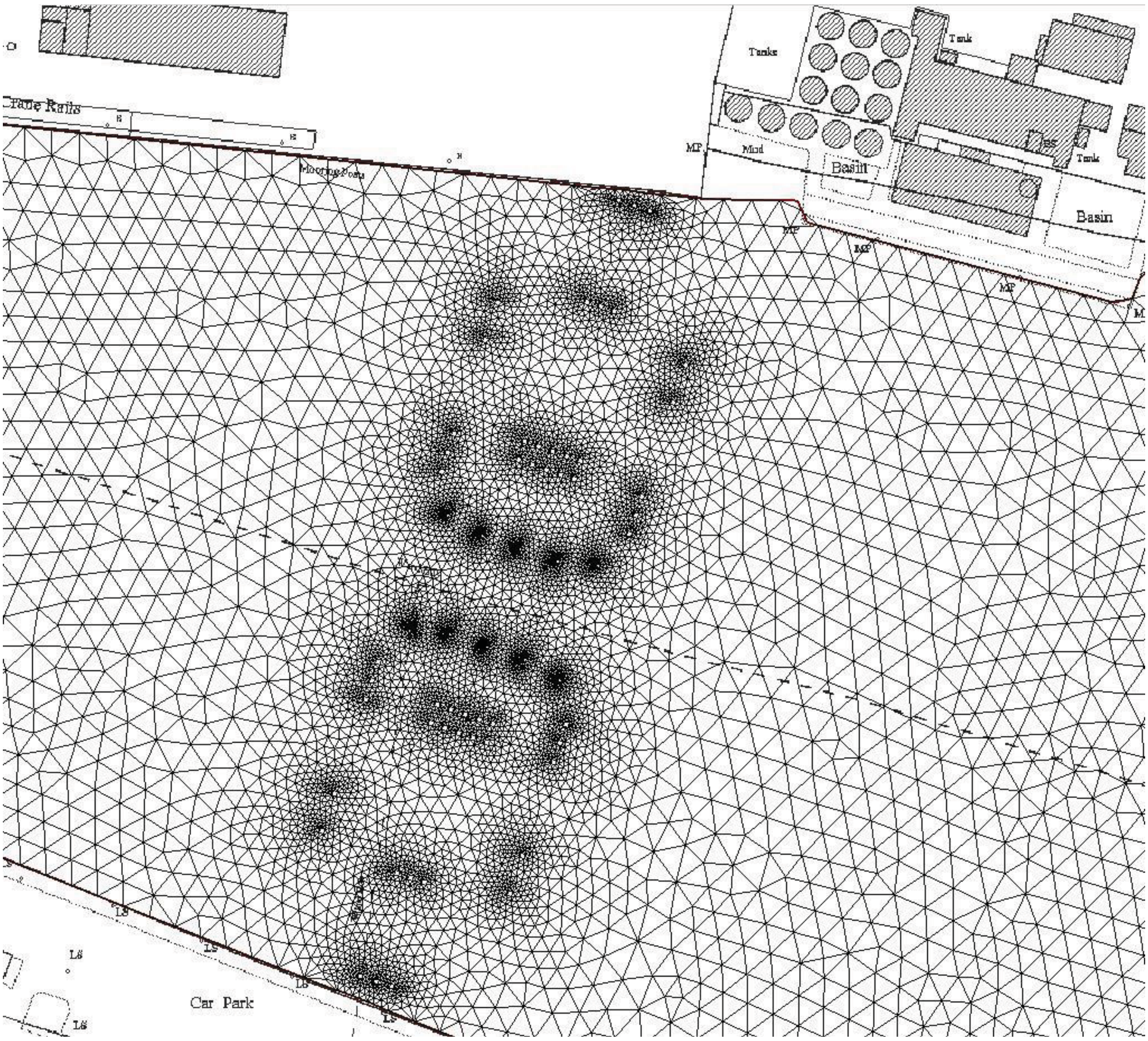


Figure 12 Bridge modelled with 1200mm diameter support Piles and Fender piles

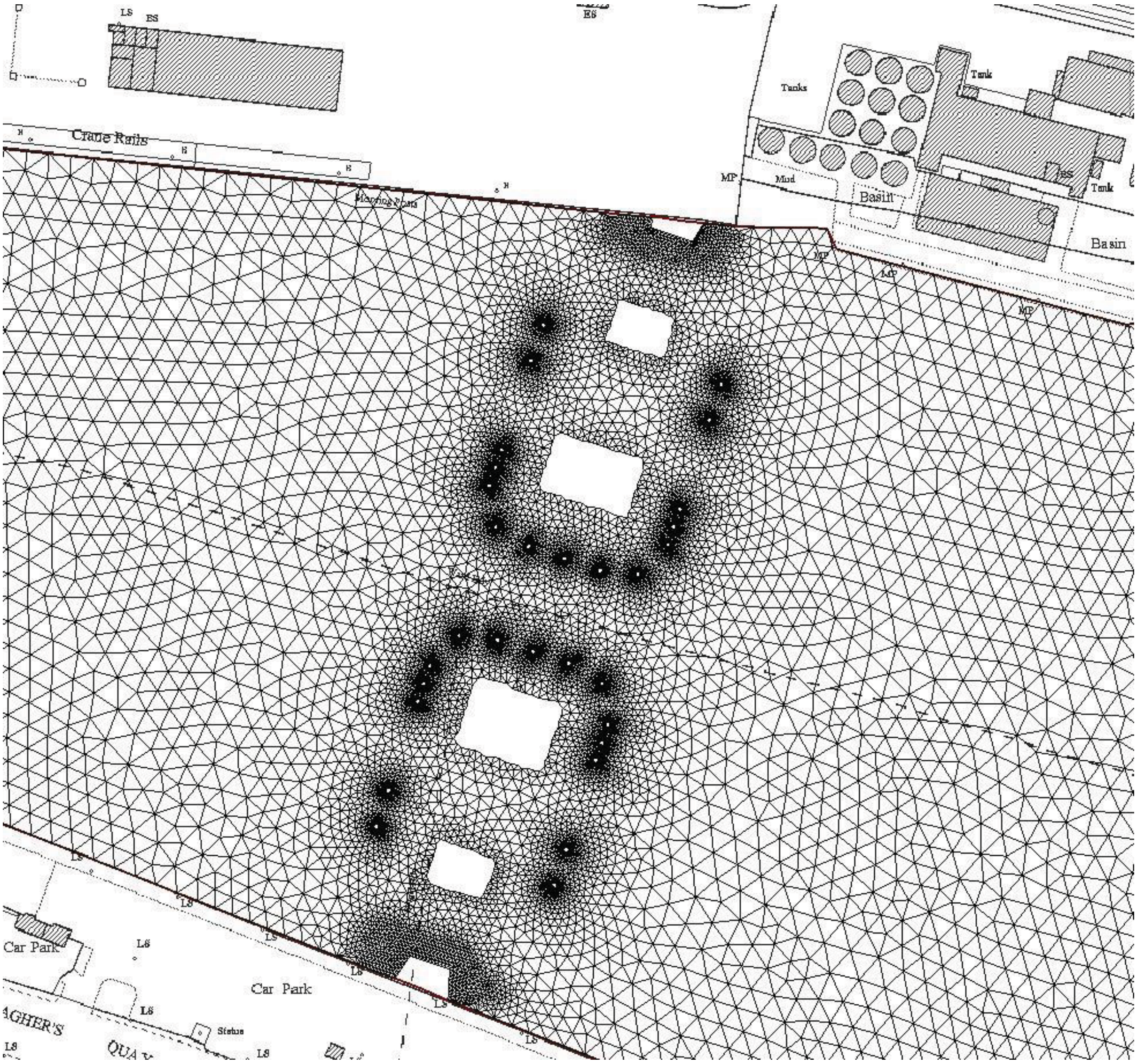


Figure 13 Bridge construction phase with temporary Cofferdams in place and Fender Piles

3. HYDRODYNAMIC SIMULATIONS

3.1 Introduction

A 24day spring – neap – spring tide using the recent tidal observations recorded from the 25th June to the 19th July 2018 was simulated so as to assess the potential change in tidal velocities and bed shear stresses within the study reach under existing and proposed conditions.

Sensitivity simulations concluded that the fluvial flow component and storm surge tide events did not have a significant effect on tidal velocities and shear stresses and that average flow conditions under normal tides were sufficient to assess the potential hydrodynamic effect and the sediment transport impacts of the proposed bridge crossing.

3.2 Model Simulation Runs

The computed neap and spring tide ebb and flood velocities for the existing (do nothing scenario) case are presented in Figures 14 to 17. These simulation results show contraction of flow and locally increased velocities around the existing piers at Edmund Rice Bridge and generally uniform flow conditions at the proposed bridge location with peak ebb and flood velocities reaching 0.6 to 0.7m/s on the neap tide and 1 to 1.1m/s on the flood towards the centre of the channel at the proposed bridge location.

The computed maximum Bed Shear Stress for the existing case is presented in Figures 18 to 21 for neap and spring flood and ebb flows respectively. These generally show 1.5 to 2 Pa for neap mid ebb and flood flows and 3 to 4 for spring mid-flood and ebb flows. Local increases are evident at sites of contraction such as the existing Edmund Rice bridge.

The tidal simulation of the proposed bridge case shows varying flow velocities caused by the contraction of flow around the pile centres and the sheltering effect and disturbance of the pile groups on velocity and local flow direction. The computed neap and spring tide ebb and flood velocities for the proposed bridge case are presented in Figures 23 to 26. These show neap ebb and flood velocities reaching 0.7 to 0.9m/s and spring velocities reaching 1.1 to 1.3m/s at the bridge.

Velocity difference plots between proposed and existing cases are presented in Figures 27 to 30 for neap and spring tides at mid-ebb and mid-flood respectively, which indicates the extent of the estuary area hydraulically impacted by the bridge structure. This represents a limited localised impact both upstream and downstream of the proposed bridge.

The computed maximum Bed Shear Stress for the existing case is presented in Figures 31 to 34 for neap and spring flood and ebb flows respectively. These plots show localised increases through the bridge and for the immediate section both upstream and downstream of the bridge with the Shear Stress increasing from 1.5 to 2.0 Pa for the existing case to 2 to 2.5Pa on neap mid-ebb and flood flows and from 3 to 4 Pa to 5 to 7Pa for spring mid-flood and ebb flows. Such increases will result in accelerated local scouring of the silts and sands.

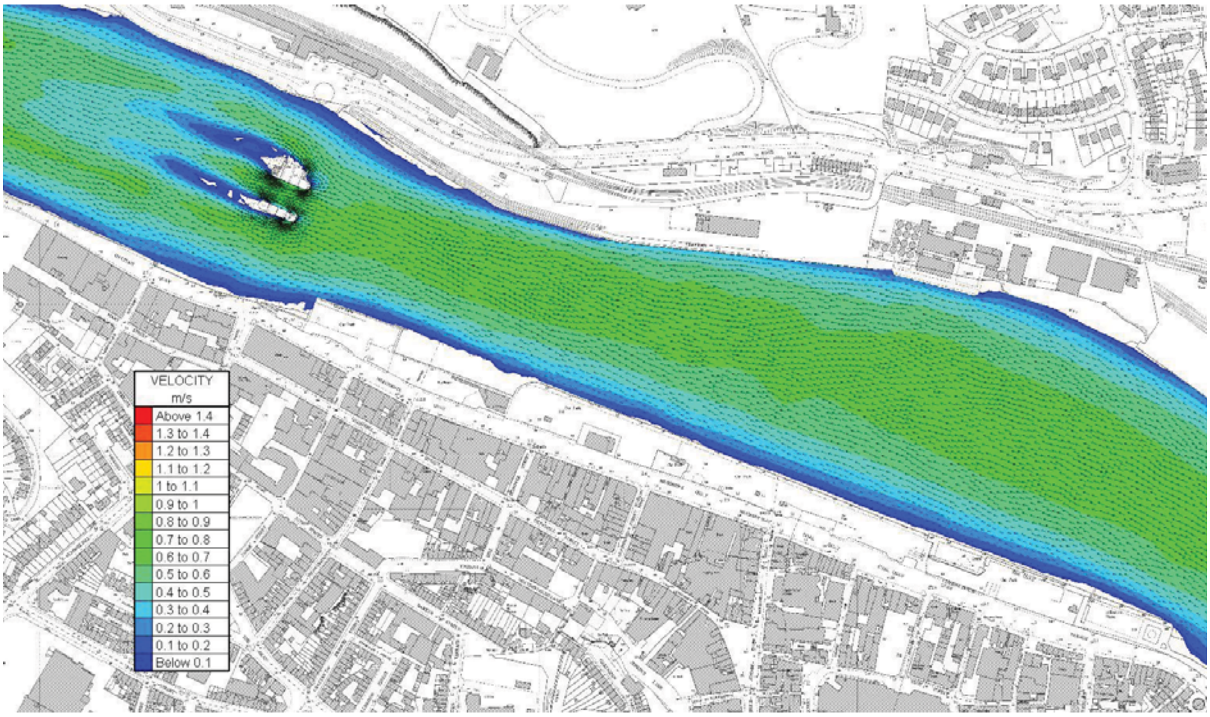


Figure 14 Neap Tide – Mid-Flood velocities under existing conditions

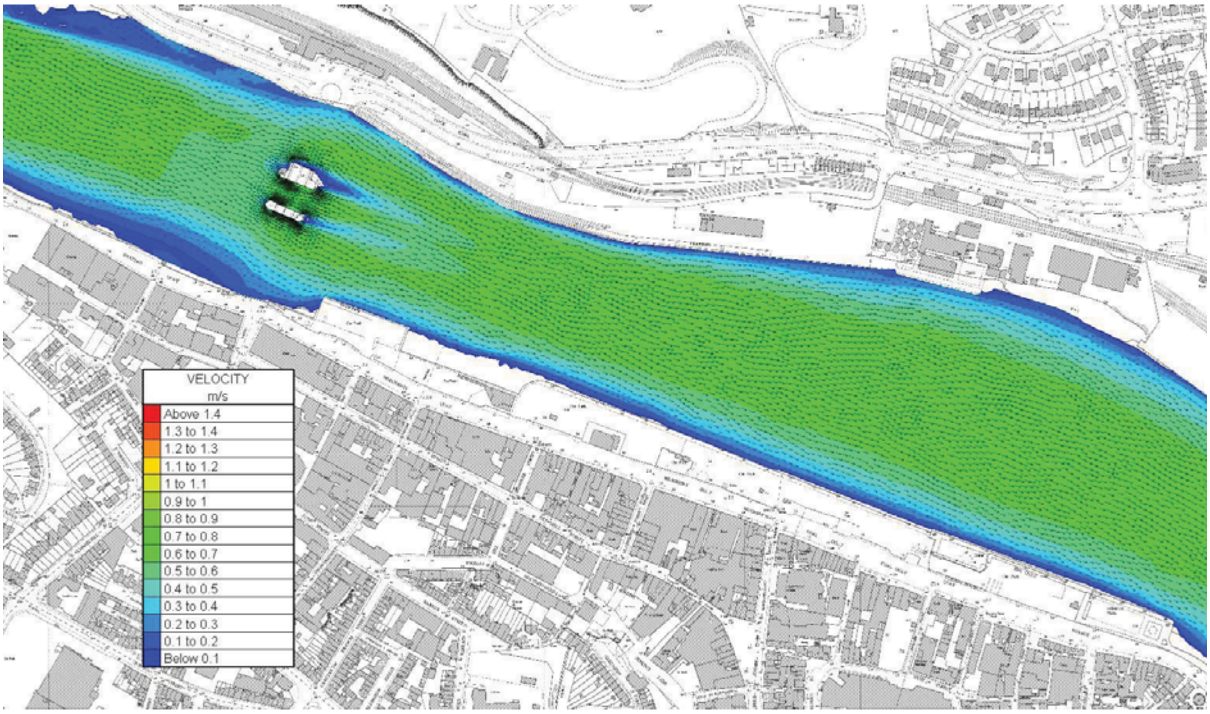


Figure 15 Neap Tide – Mid-Ebb velocities under existing conditions

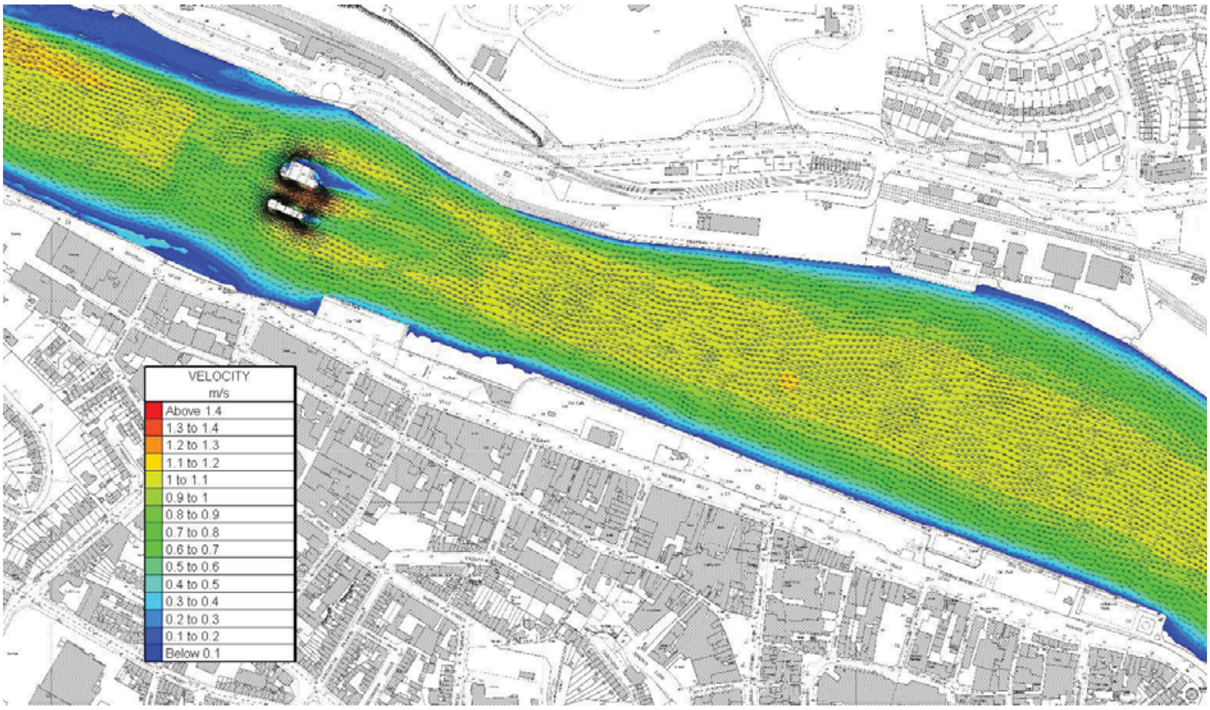


Figure 16 Spring Tide – Mid-Ebb velocities under existing conditions

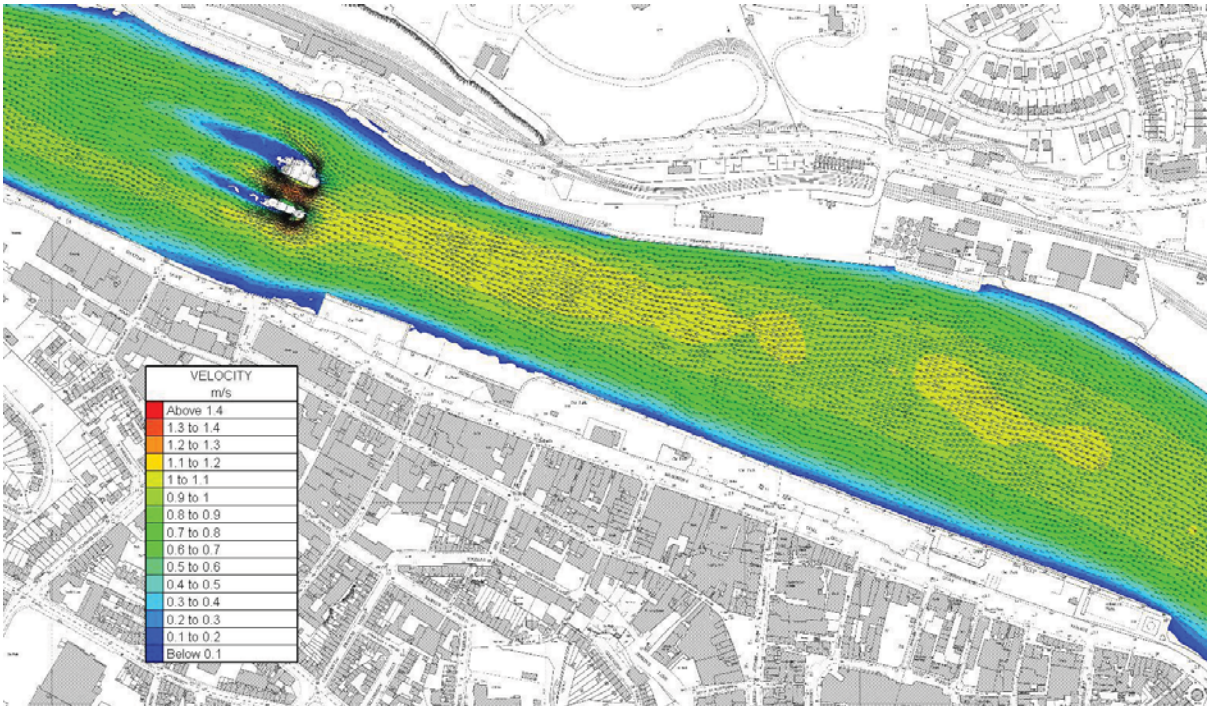


Figure 17 Spring Tide – Mid-Flood velocities under existing conditions

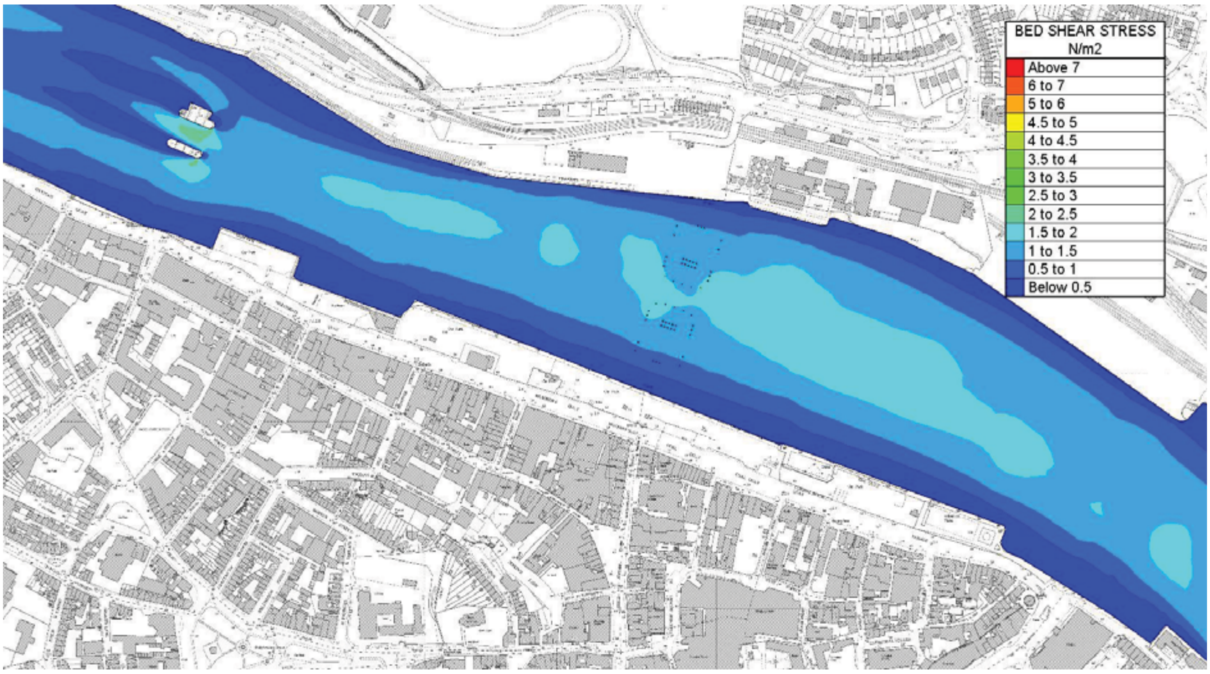


Figure 18 Computed bed shear stress Neap Tide – Mid-Flood – Existing Case

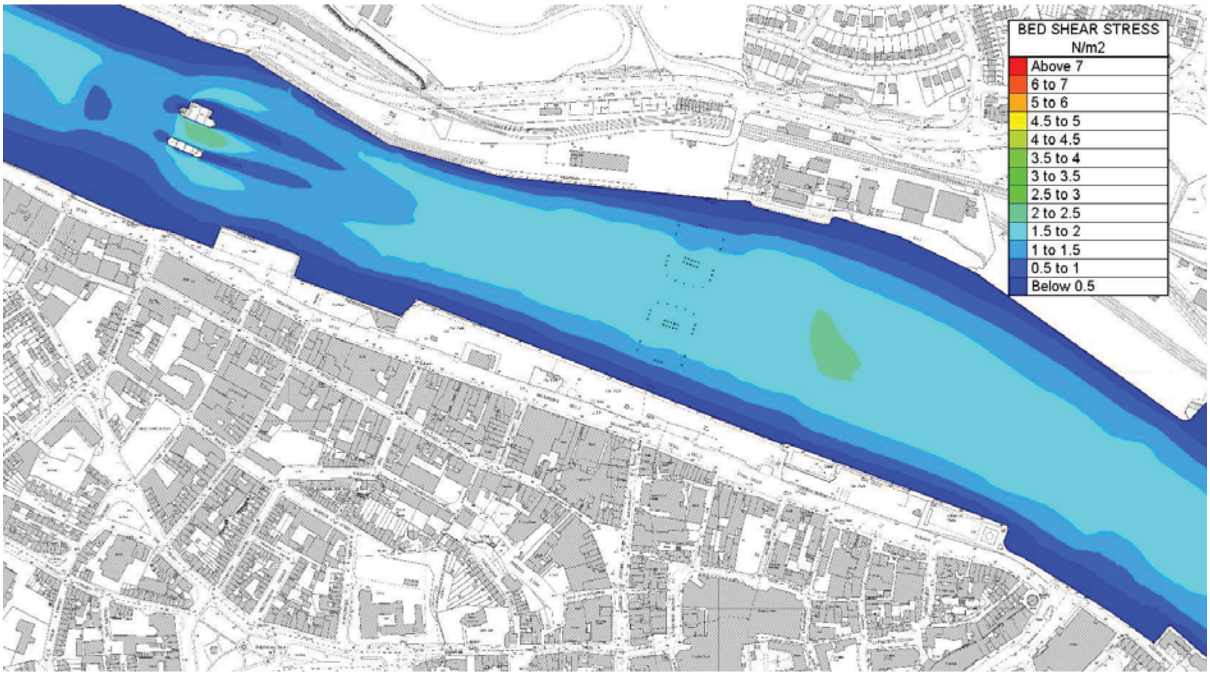


Figure 19 Computed bed shear stress Neap Tide – Mid-Ebb – Existing Case

Note Proposed Location of bridge pile foundation shown

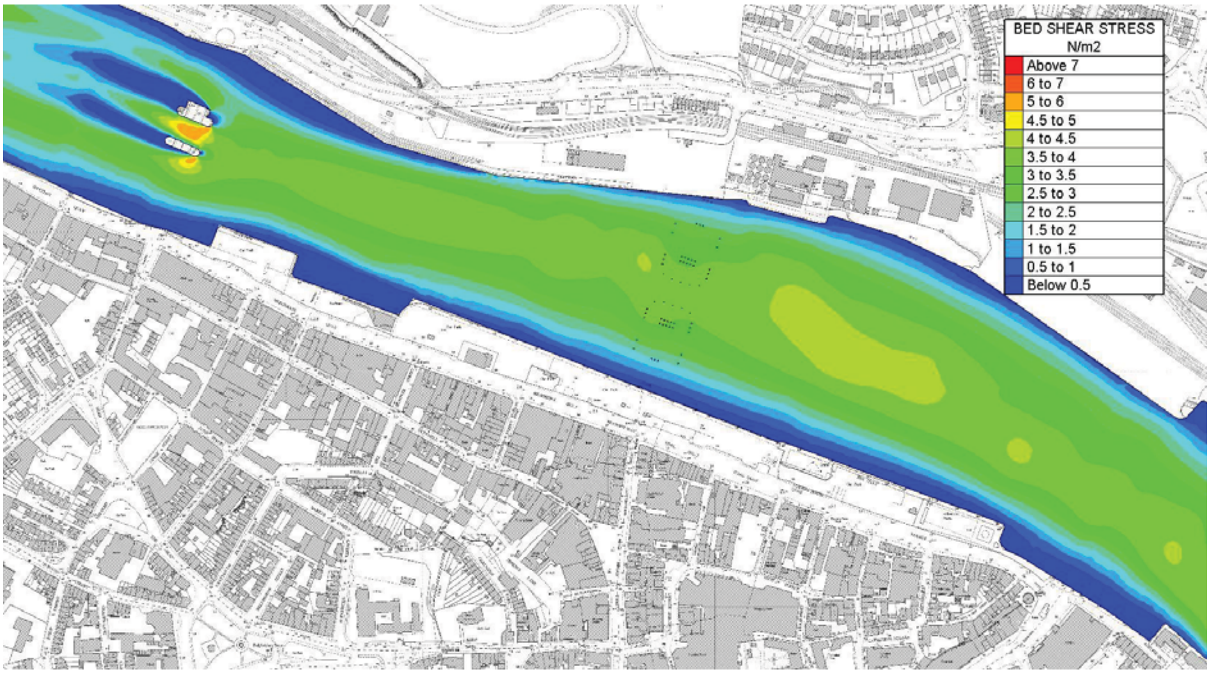


Figure 20 Computed bed shear stress Spring Tide – Mid-Flood – Existing Case

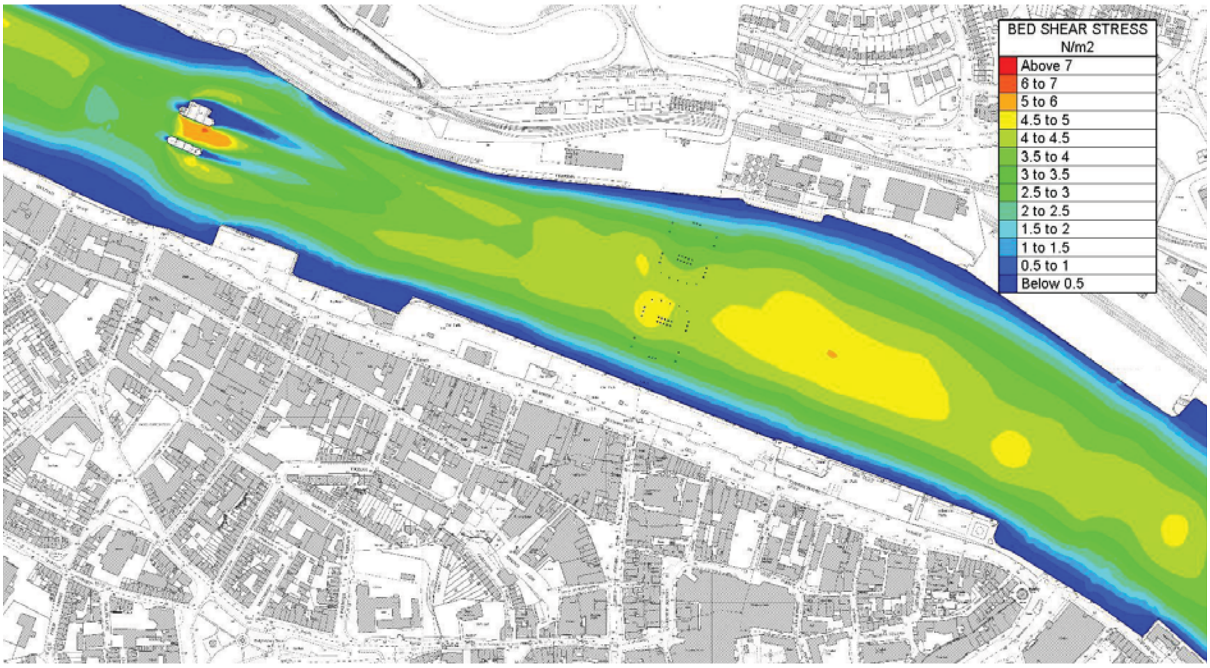


Figure 21 Computed bed shear stress Spring Tide – Mid-Ebb – Existing Case

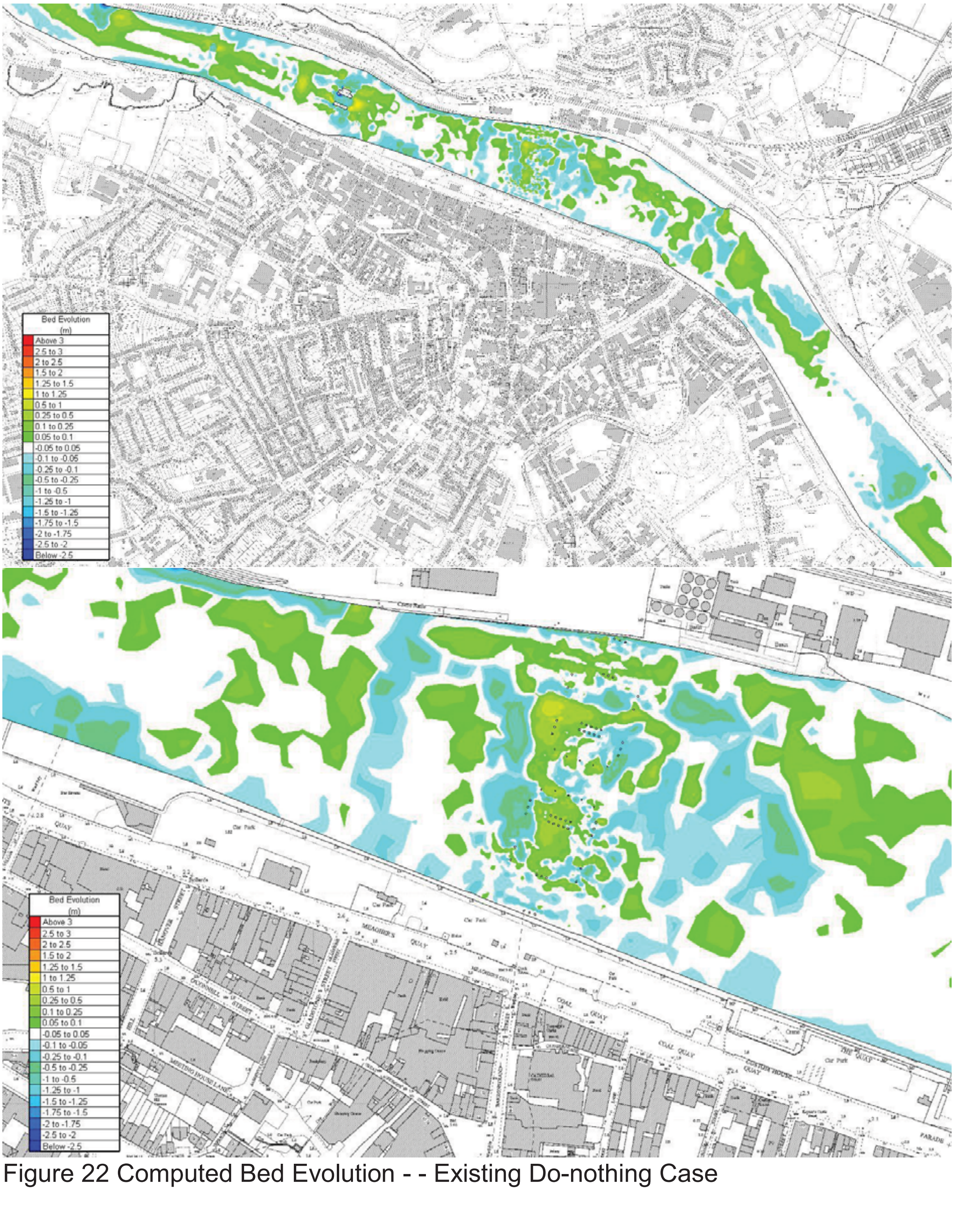


Figure 22 Computed Bed Evolution - - Existing Do-nothing Case

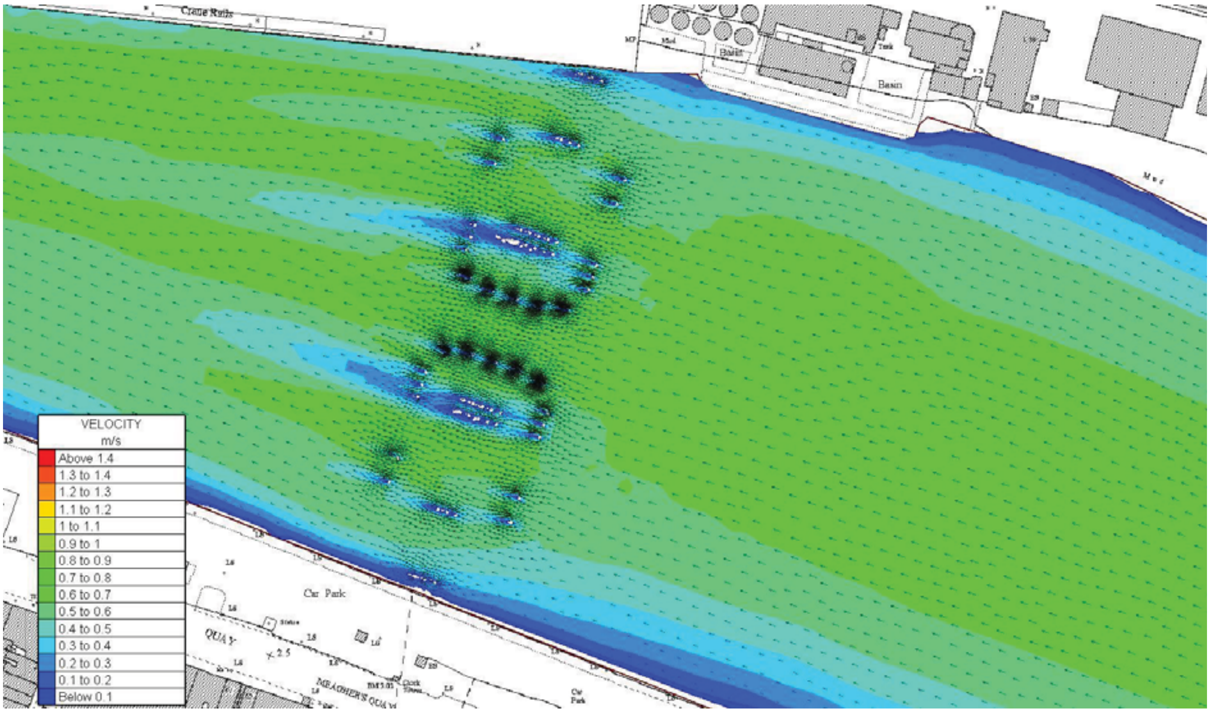


Figure 23 Neap Tide – Mid-Flood velocities for proposed bridge case

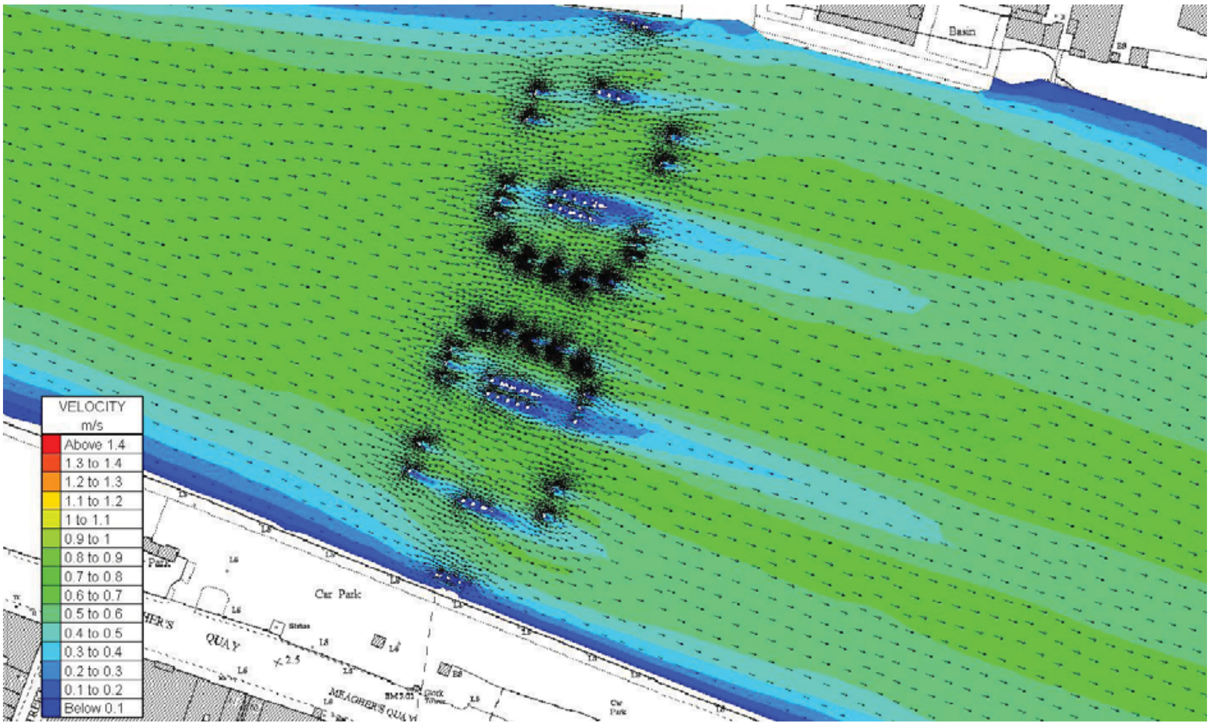


Figure 24 Neap -Tide Mid-Ebb velocities for proposed bridge case

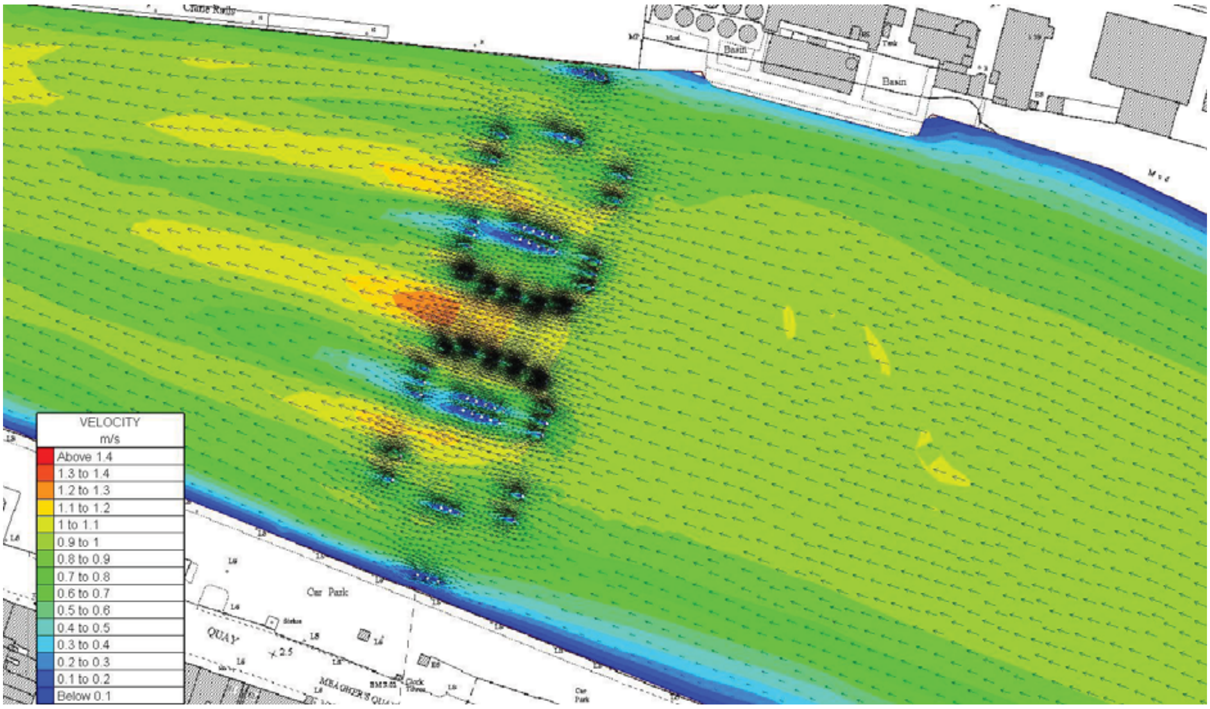


Figure 25 Spring Tide – Mid-Flood velocities for proposed bridge case

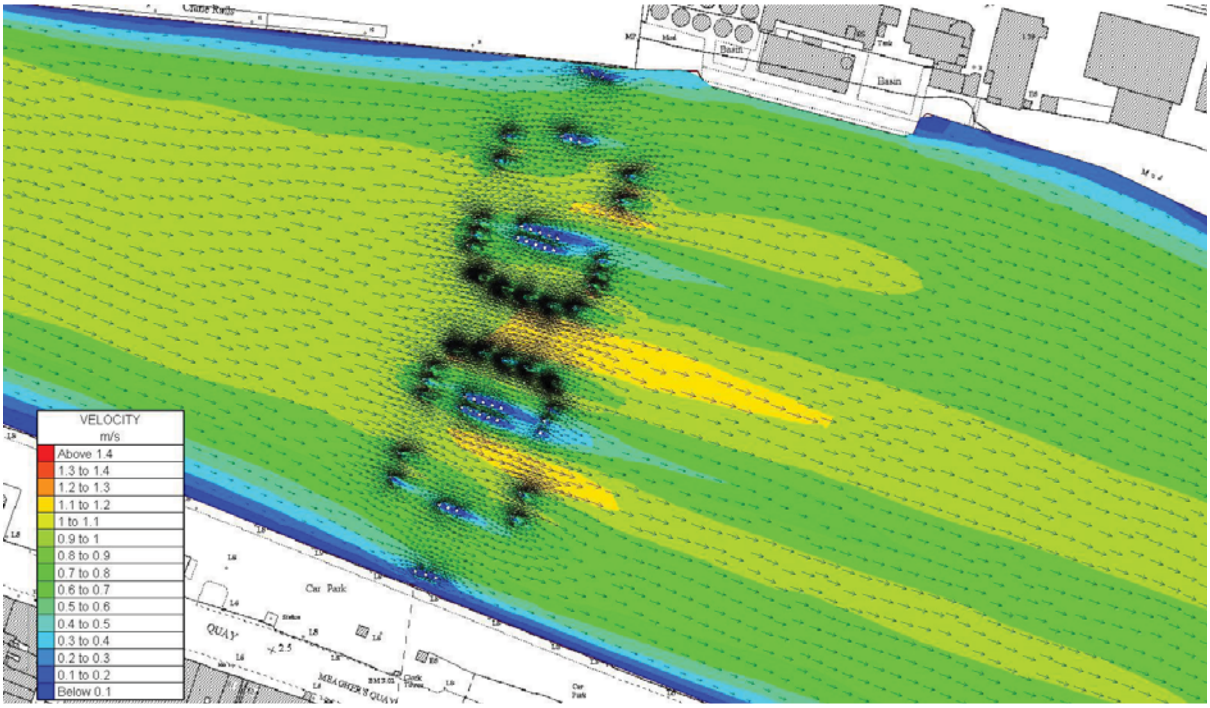


Figure 26 Spring Tide – Mid- Ebb velocities for proposed bridge case

Figure 27 Computed change in velocity magnitude as a result of the proposed bridge – Neap Tide Mid-Flood

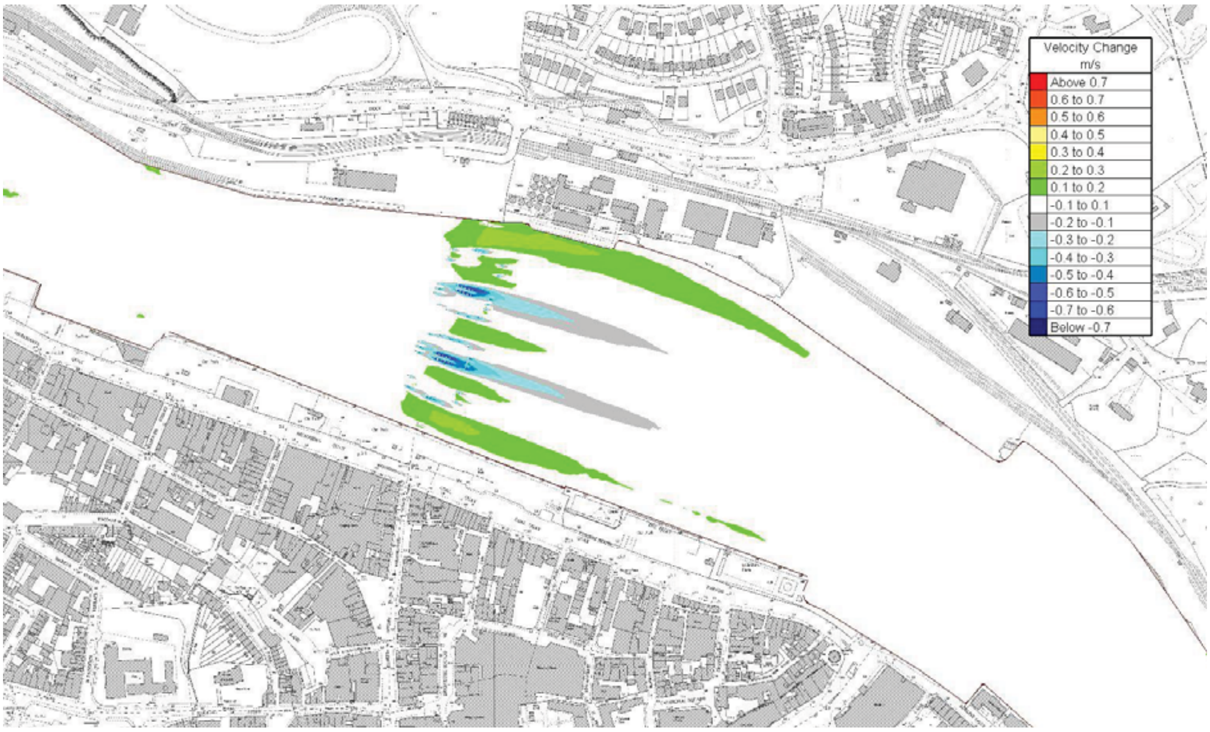


Figure 28 Computed change in velocity magnitude as a result of the bridge – Neap Tide Mid-Ebb

Figure 29 Computed change in velocity magnitude as a result of the bridge – Spring Tide Mid-Flood

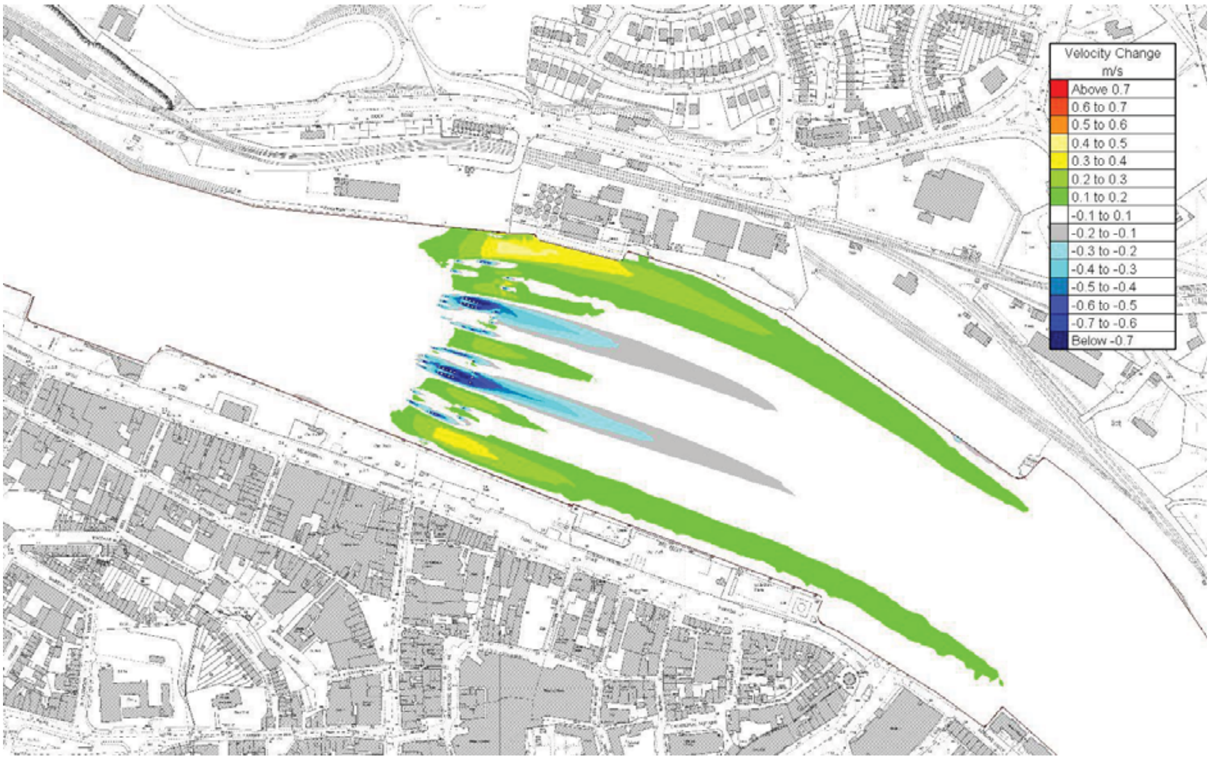


Figure 30 Computed change in velocity magnitude as a result of the Bridge – Spring Tide Mid-Ebb

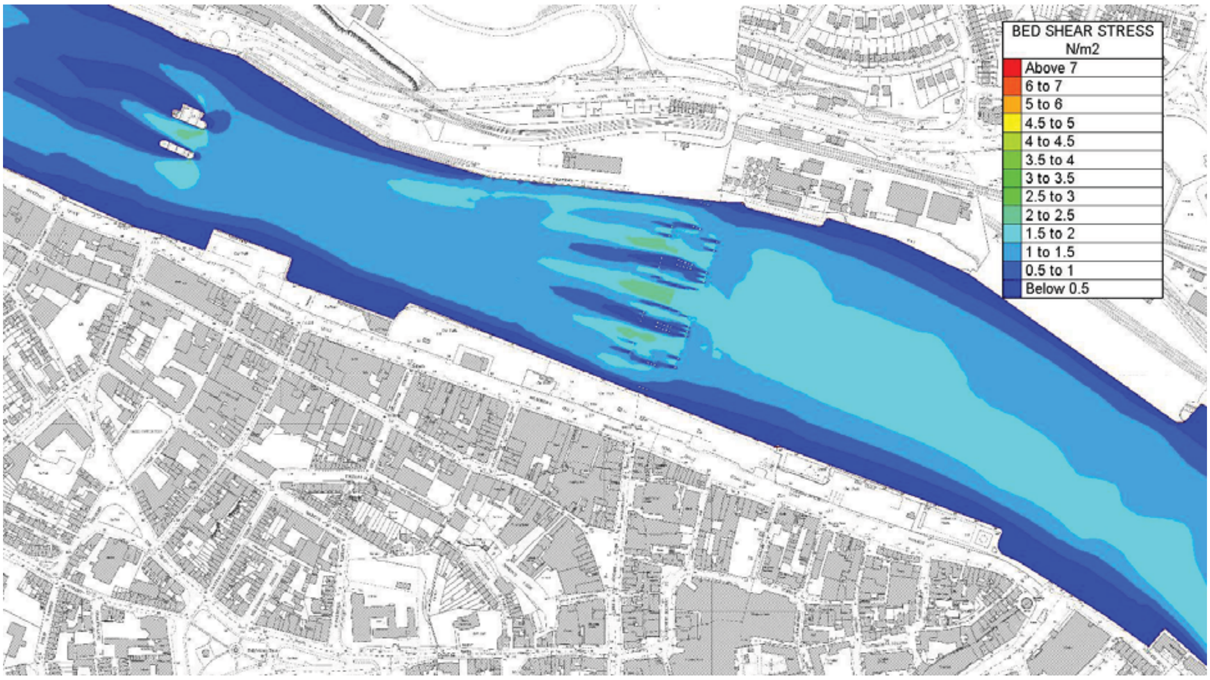


Figure 31 Computed bed shear stress Neap Tide – Mid-Flood – Bridge Case

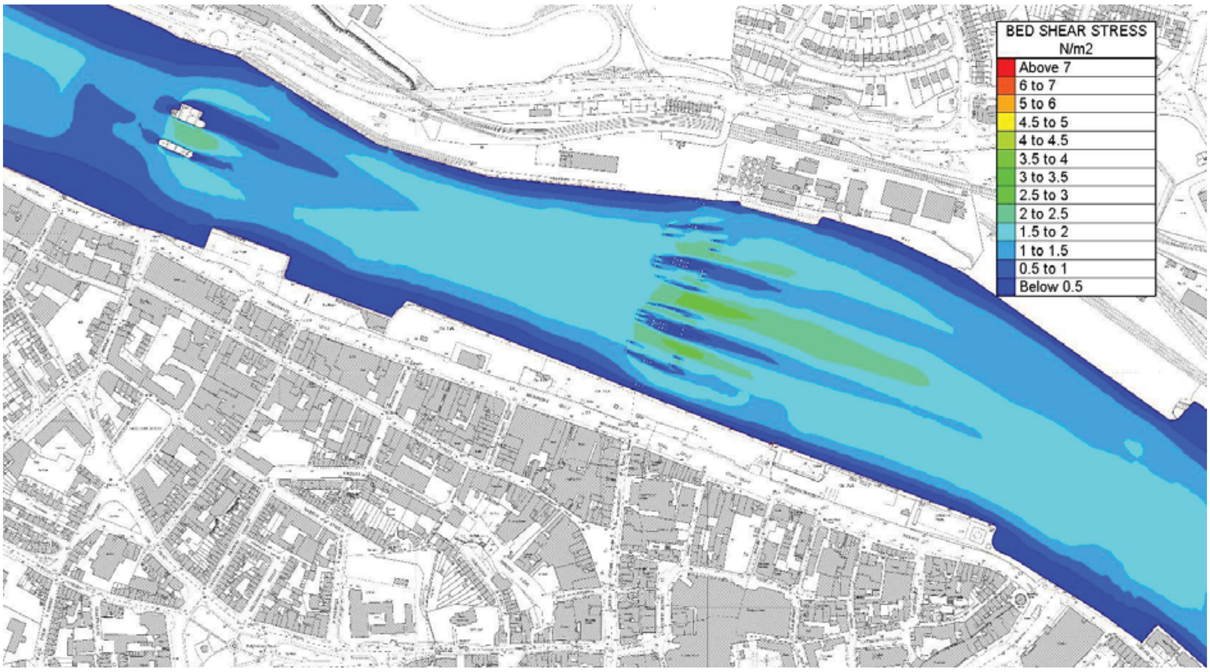


Figure 32 Computed bed shear stress Neap Tide – Mid-Ebb – Bridge Case

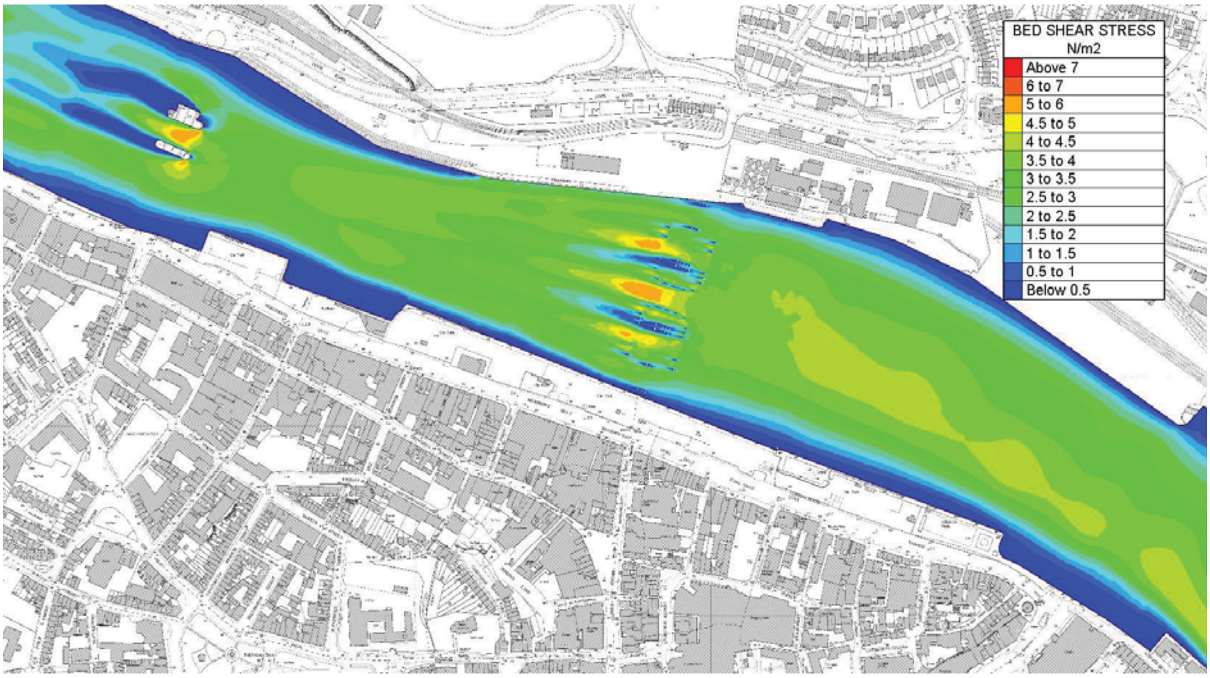


Figure 33 Computed bed shear stress Spring Tide – Mid-Flood – Bridge Case

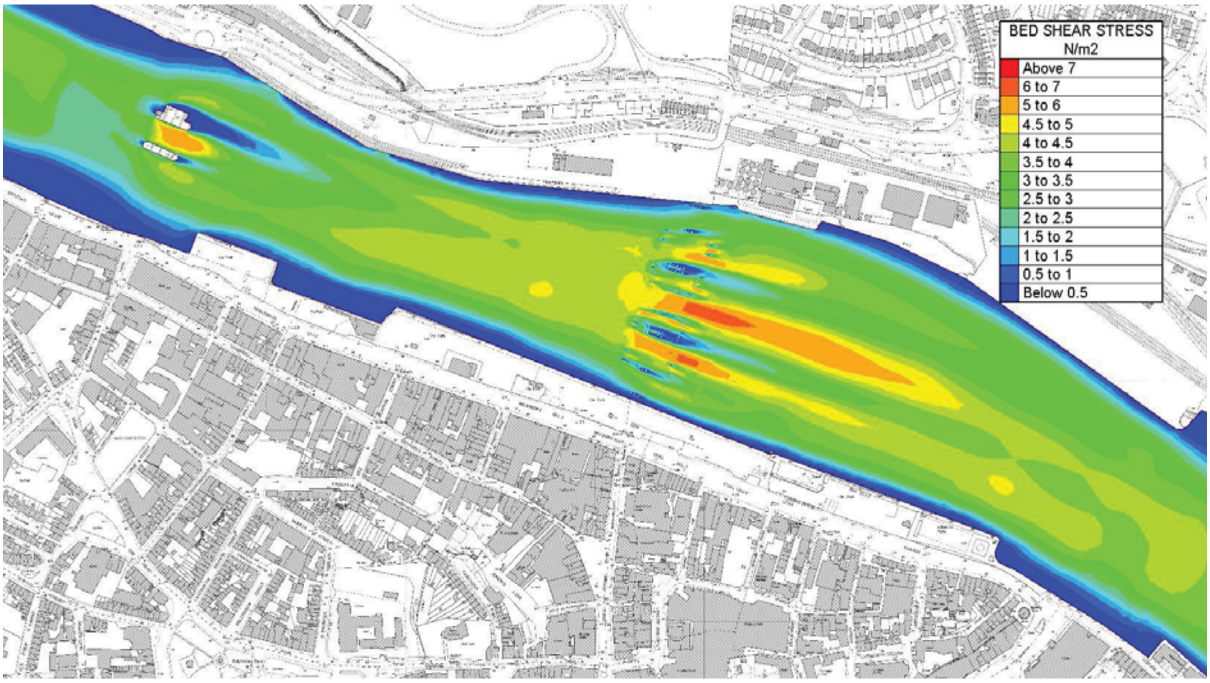


Figure 34 Computed bed shear stress Spring Tide – Mid-Ebb – Bridge Case

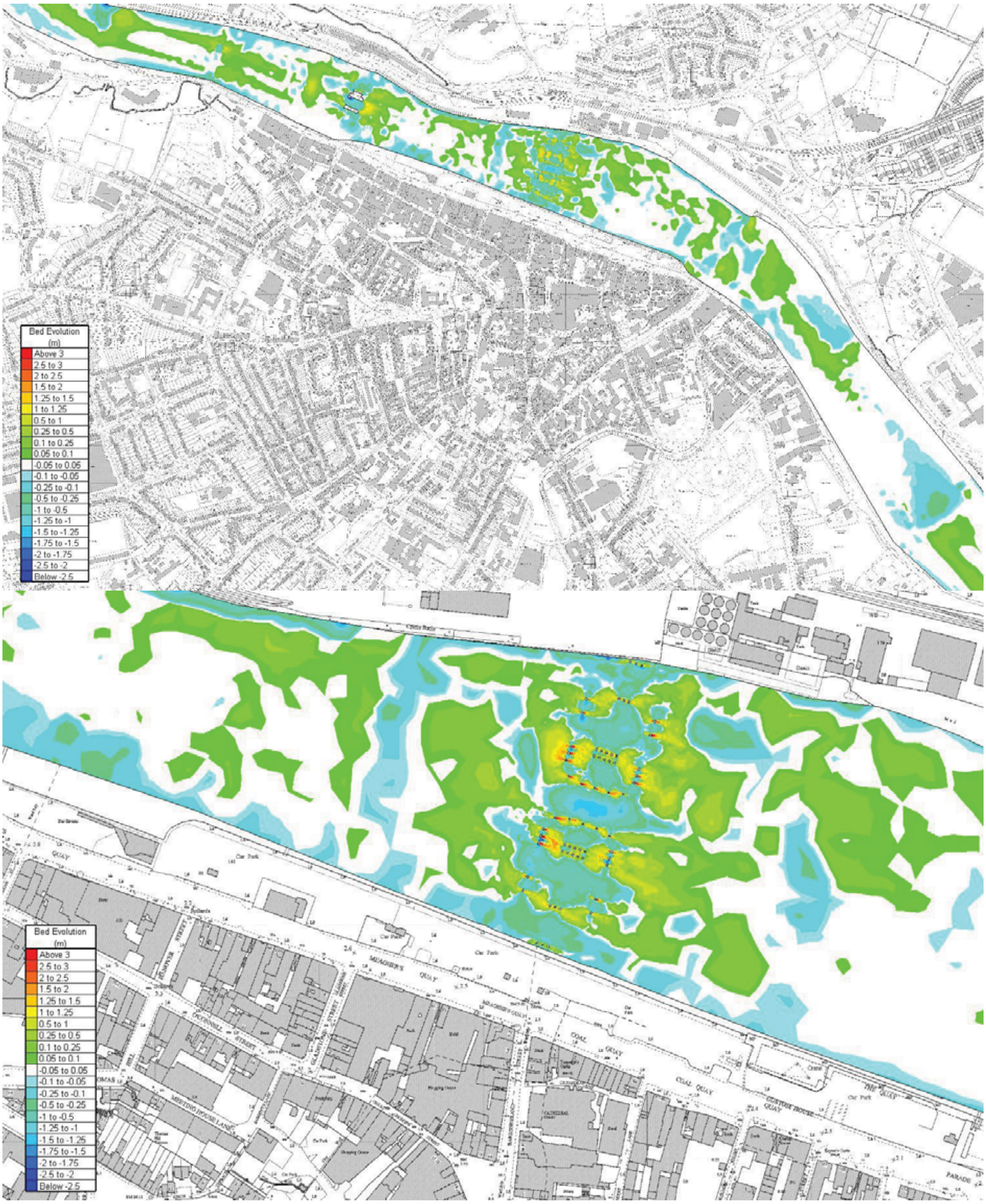


Figure 35 Computed Bed Evolution - Proposed Bridge Case

3.3 Construction Phase Simulation

A worst case scenario was examined with the proposed sheet pilling in place surrounding all bridge piers and the fender piles in place also. This scenario represents a significant contraction of the flow streamlines through the structure resulting in increased velocities.

The computed neap and spring tide ebb and flood velocities for the proposed bridge are presented in Figures 36 to 39. These show neap, ebb and flood velocities reaching 0.7 to 0.9m/s and spring velocities reaching up to 1.2 to 1.4m/s at the bridge.

Velocity difference plots between proposed and existing cases are presented in Figures 44 to 47 for neap and spring tides at mid-ebb and mid-flood respectively, which indicates the extent of the estuary area hydraulically impacted by the bridge structure during construction. This represents a limited localised impact at the bridge and both upstream and downstream of the proposed bridge.

The computed maximum Bed Shear Stress for the existing case is presented in Figures 40 to 43 for neap and spring flood and ebb flows respectively. These plots show localised increases through the bridge and for the immediate section both upstream and downstream of the bridge with the Shear Stress increasing from 1.5 to 2.0 Pa for to the existing case to 2.5 to 3Pa on neap mid-ebb and flood flows and from 3 to 4 Pa to in excess of 7Pa for spring mid-flood and ebb flows. Such increases will result in accelerated local scouring of the silts and sands.

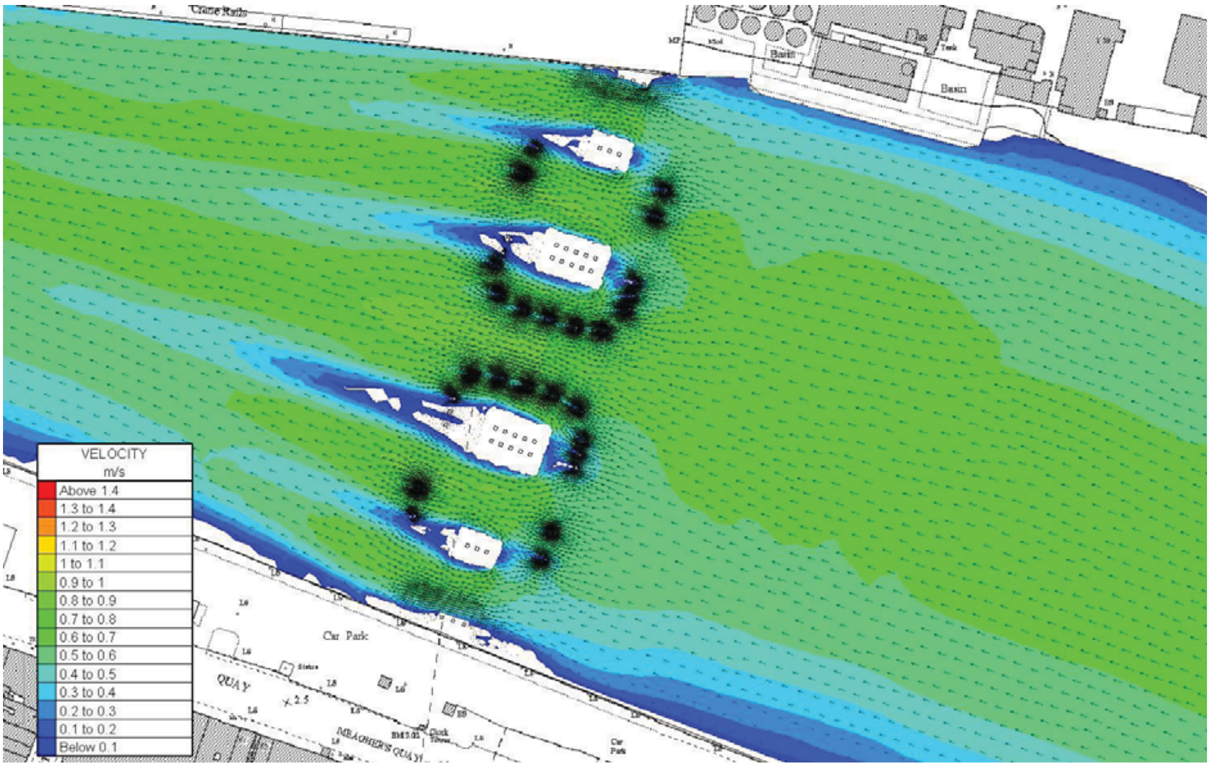


Figure 36 Neap Tide – Mid-Flood velocities for proposed Construction Phase case

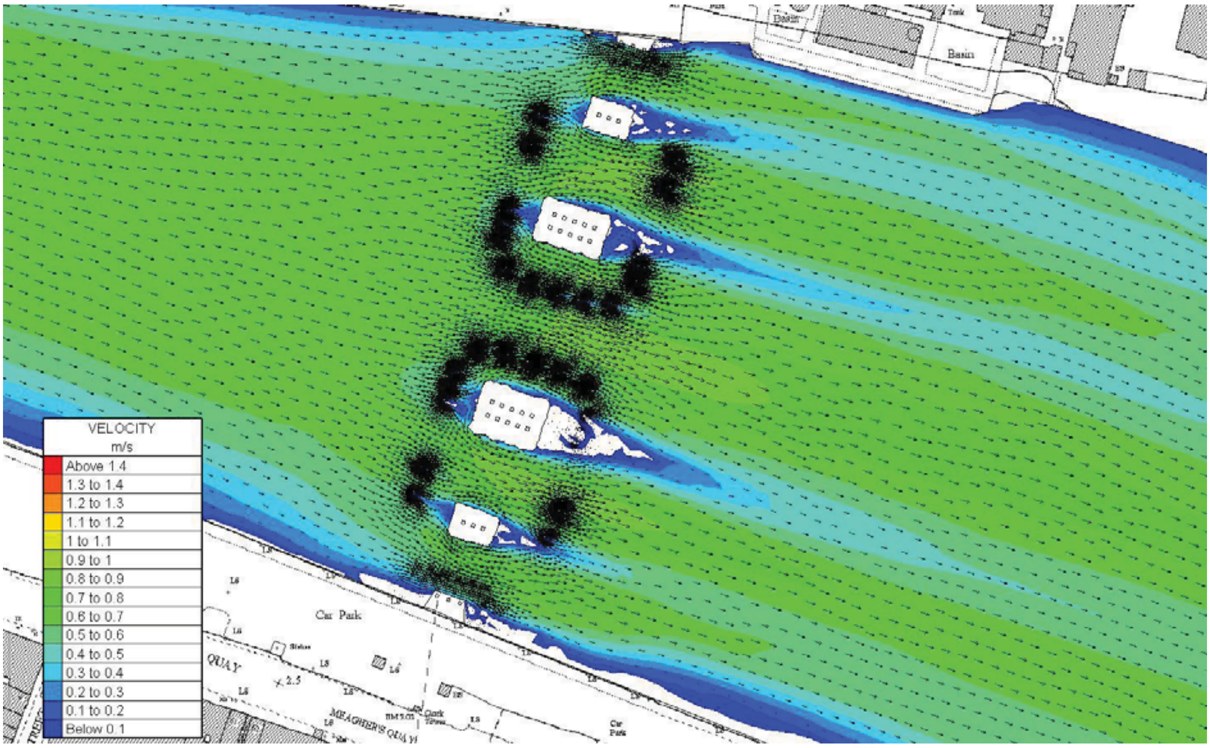


Figure 37 Neap -Tide Mid-Ebb velocities for proposed Construction Phase case

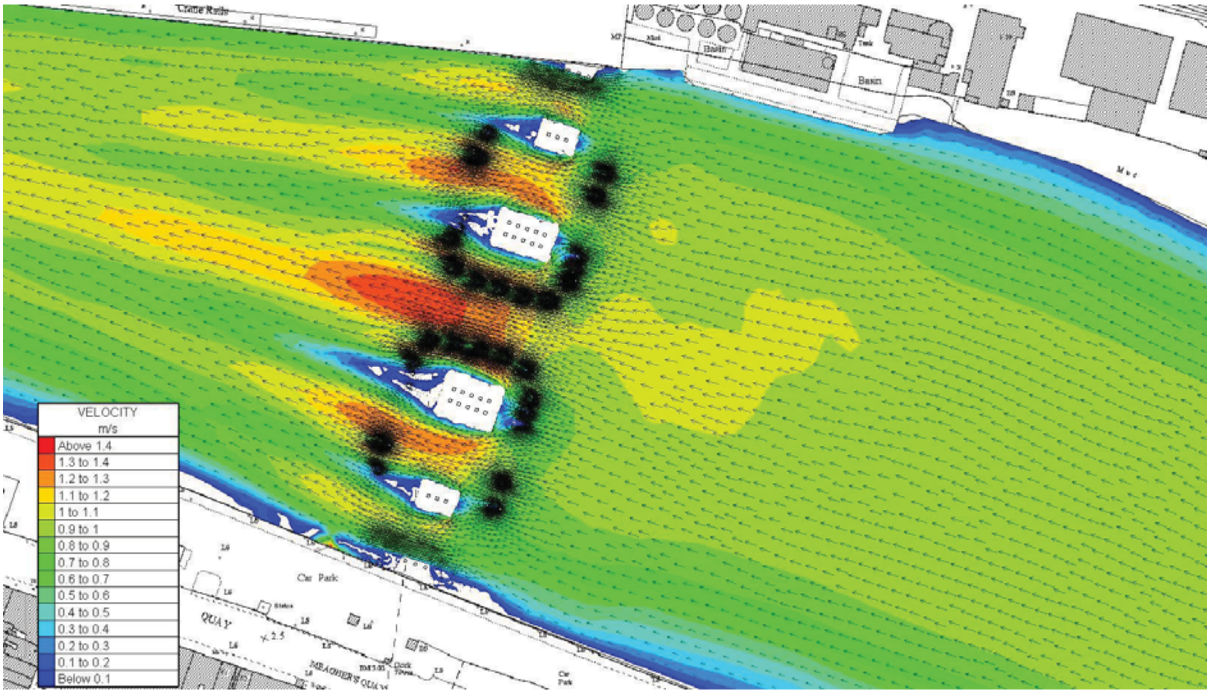


Figure 38 Spring Tide – Mid- Flood velocities for proposed Construction Phase case

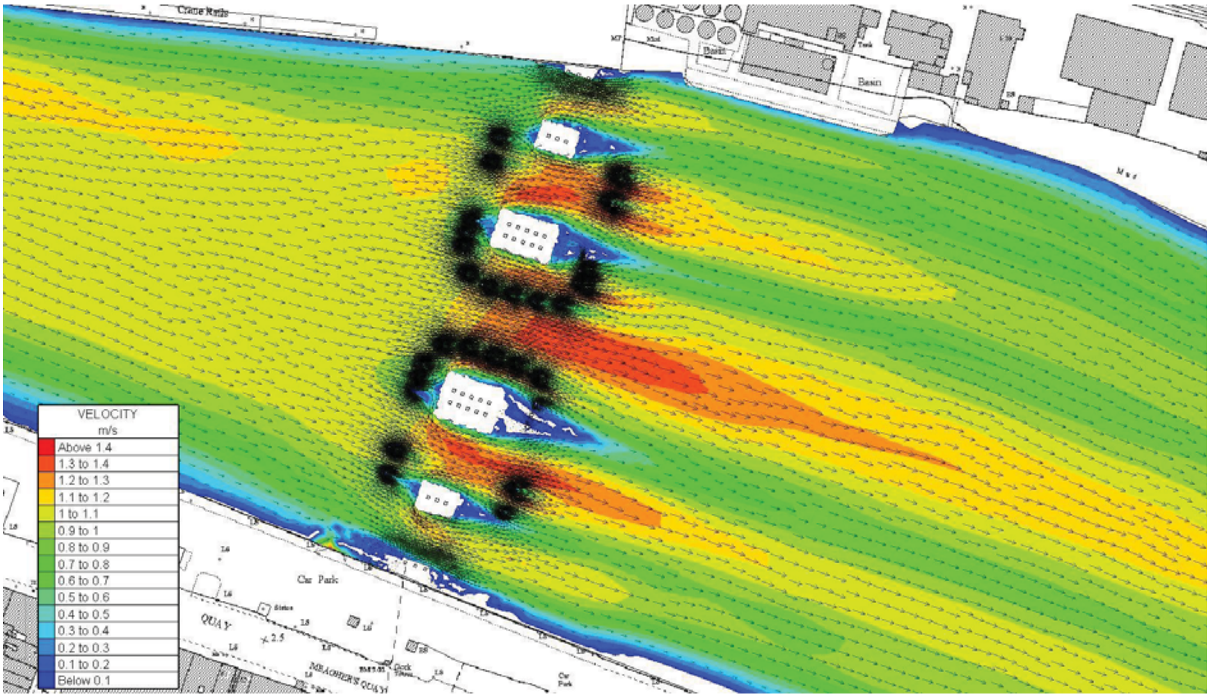


Figure 39 Spring Tide – Mid-Ebb velocities for proposed Construction Phase case

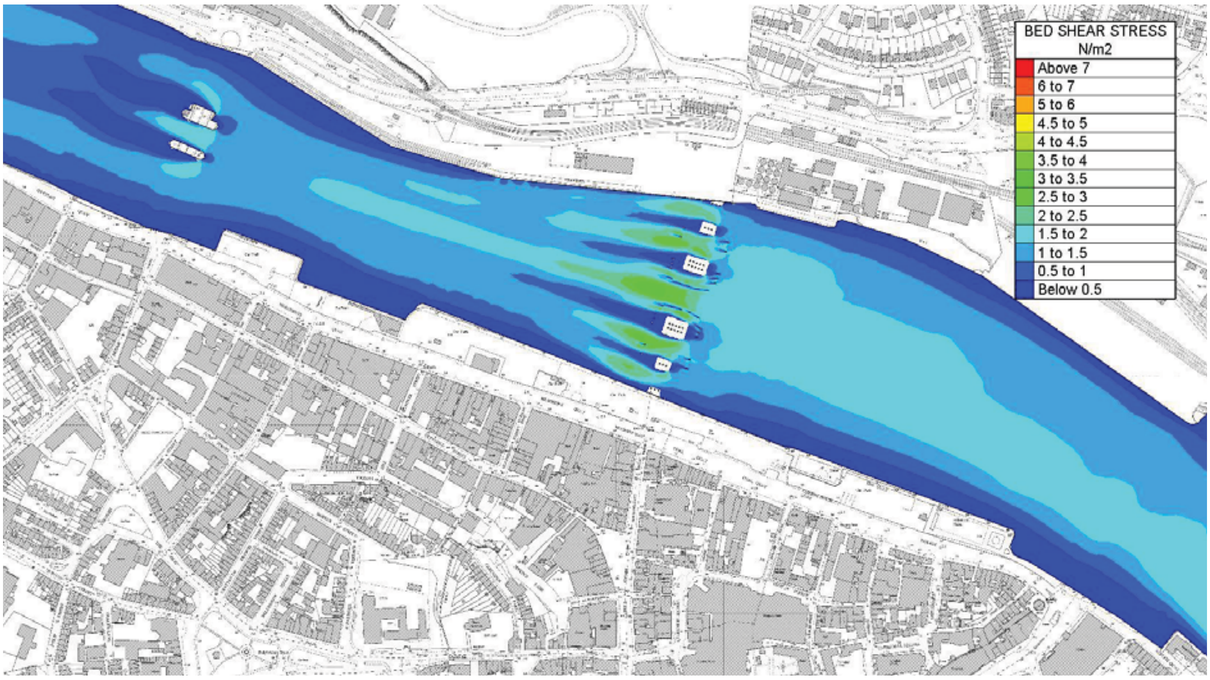


Figure 40 Computed bed shear stress Neap Tide – Mid-Flood – Construction Case

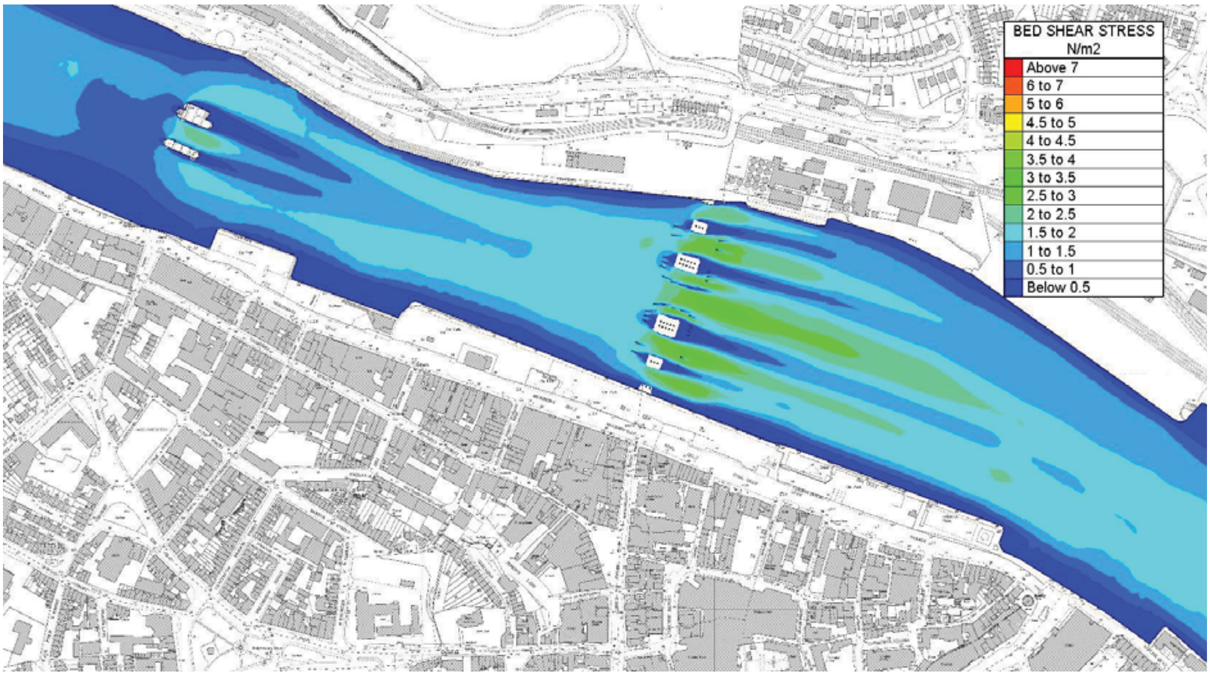


Figure 41 Computed bed shear stress Neap Tide – Mid-Ebb – Construction Case

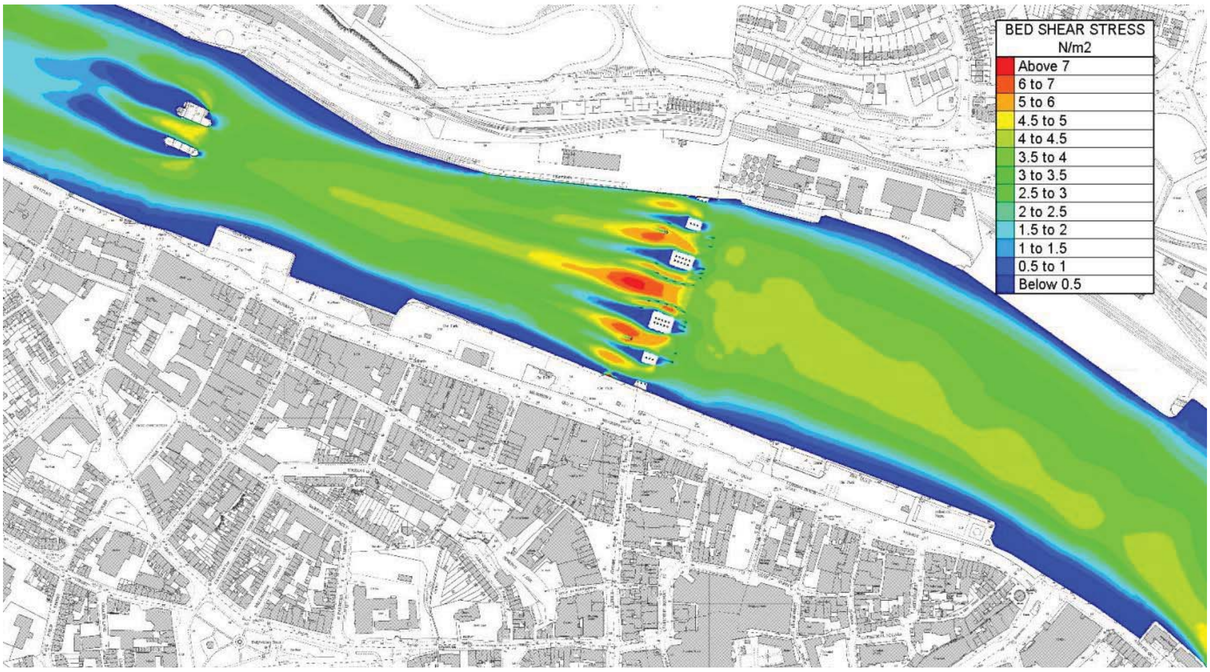


Figure 42 Computed bed shear stress Spring Tide – Mid-Flood – Construction Case

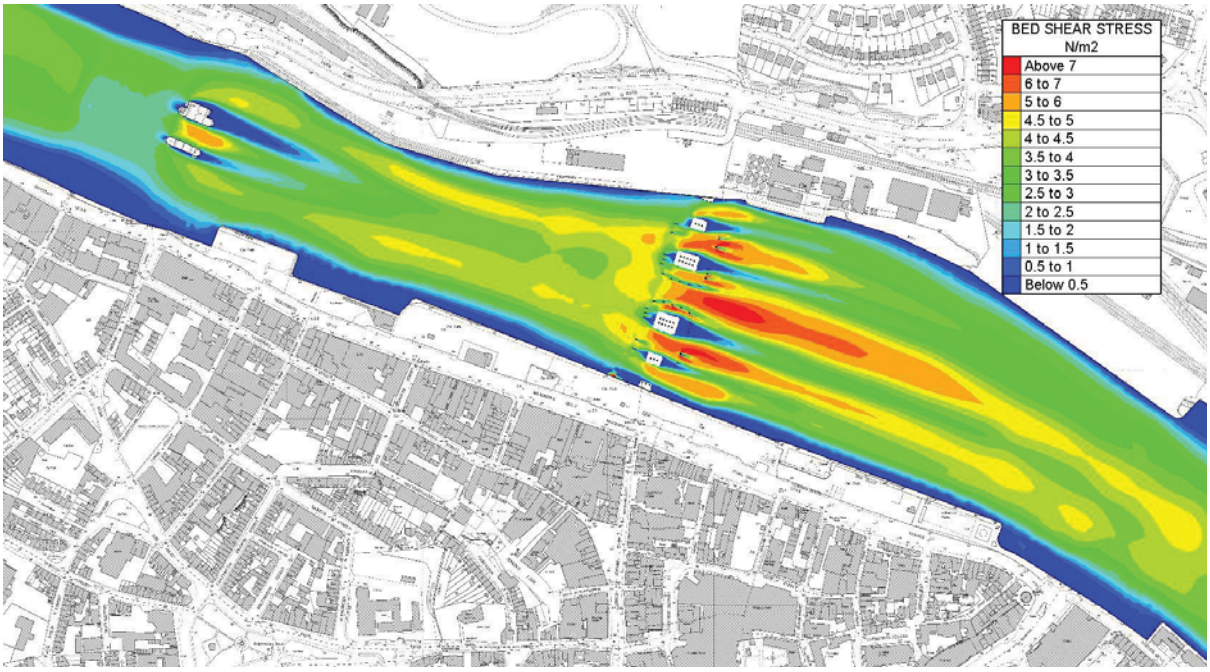


Figure 43 Computed bed shear stress Spring Tide – Mid-Ebb – Construction Case

Figure 44 Computed change in velocity magnitude at Construction Phase – Neap Tide Mid-Ebb

Figure 45 Computed change in velocity magnitude at Construction Phase – Neap Tide Mid-Flood

Figure 46 Computed change in velocity magnitude at Construction Phase – Spring Tide Mid-Ebb

Figure 47 Computed change in velocity magnitude at Construction Phase - Spring Tide Mid-Flood

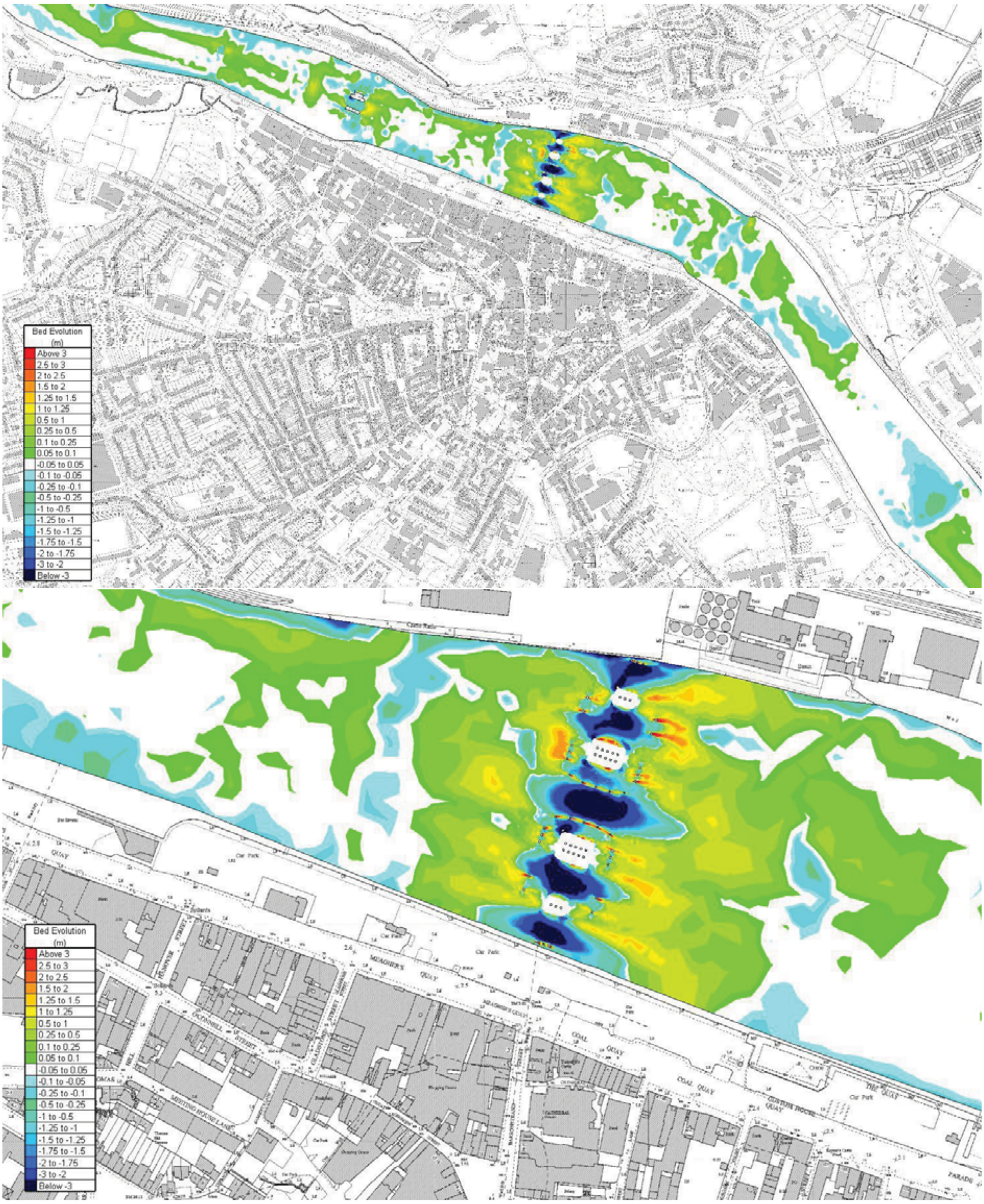


Figure 48 Computed Bed Evolution - Construction Phase

4 DISCUSSION

Sediment transport modelling of the 24day springs–neaps-springs tidal cycles was carried out to quantify the sediment transport effects of the proposed bridge. The bed evolution plot at the end of the 24day simulation is presented in Figure 22 modelling a sediment of 25% silt, 60% sand and 15% gravel for the existing “Do nothing” case. Under the existing case the silt is scoured away and transported in suspension and becoming well mixed and distributed in the downstream reach forming part of the natural dynamic suspended sediment load in the estuary. The sands and gravels are locally transported and the existing case indicated that on-going erosion and deposition is naturally occurring throughout the estuary. The existing case indicates significant erosion is taking place in the navigation channel through Rice Bridge. However it most probable at this location that the bed has naturally armoured itself overtime with the heavier gravels, and cobbles left behind forming a protective capping that prevents further erosion. It should also be noted that the timber piles from the former wooden bridge at the site may still be in place providing a degree of bed stabilisation.

Under the proposed case the silt fraction similar to the existing case is easily eroded and transported in suspension with the tidal flows and is well mixed and distributed throughout the downstream reach forming part of the natural dynamic suspended sediment load in the estuary. The simulation shows that the proposed bridge, due to the contraction effect on the velocity distribution, results in localised erosion at the structure principally away from the piles with the deposition of the eroded material occurring local to the site both upstream and downstream of the bridge. The extent of deposition from the scouring is located within 150m upstream of the bridge and 300m downstream. The scour depth at the bridge after a 24day simulation period is 1.5m and it is likely to double to 3m over time after which an armouring layer of the heavier fractions left behind will prevent further scouring of the channel at the bridge. The deposited sandy sediments is likely to slowly migrate downstream becoming more distributed spatially with distance downstream.

The construction case looks at worst case scenario with all cofferdams in place around the bridge piles and also the fender piles in place. This scenario significantly contracts flow through the bridge resulting in significantly increased velocity and shear stress over the existing case and thus giving rise to accelerated and deep scouring locally with a shear stress on the spring tides of over 7 Pa predicted. The predicted scour depth in the channel between the cofferdams is 4 to 4.5m after a 24 day simulation with the sediment deposited locally in the channel within 150m upstream and 300m downstream, refer to Figure 48.

It is recommended, given the depth of scouring predicted, that cofferdams around the support pile sites should not be in place at the same time so as to limit the degree of contraction and reduce scouring.

Chapter 11
Landscape and Visual

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 11 Landscape and Visual

11.1 Introduction

Murray & Associates conducted the landscape and visual assessment for the proposed River Suir Sustainable Transport Bridge. The proposed site is located in Waterford City centre, spanning the River Suir from Meagher's Quay to the south of the river to the North Quays (Strategic Development Zone (SDZ) lands).

The proposed development comprises a 207m long new bridge across the River Suir, 8m in width, with four piers and a 32.5m opening span in the centre of the river which provides a 25m navigable channel and south plaza bridge approach containing the plant rooms / building for the south bascule.

The landscape and visual assessment of the proposed development is a means of appraising the affect the proposed development would have on the receiving environment in terms of quality of landscape – both physically and visually. The assessment aims to indicate the layout and design of the proposed development which would present the least overall landscape and visual impact.

As part of the assessment, the site and its environs were visited in March 2017.

This chapter has been prepared by Mark Boyle, BAgrSc(LH), MLArch, MILI, director of Murray & Associates, Landscape Architecture. Mark Boyle is a full member of the Irish Landscape Institute and has been carrying out landscape and visual impact assessments for Environmental Impact Statements (EIS)/Environmental Impact Assessment Reports (EIAR) and as standalone reports since commencing practice with Murray & Associates in 1998. Key previous landscape and visual impact assessment (LVIA) projects include N69 Foynes-Limerick (2015-present); R494 Killaloe Bypass, Shannon River Crossing and upgrade to Ballina, Counties Clare and Tipperary – LVIA (2008-2012); LUAS Line F Route Assessment (2007-10); Metro West Rail Development - Tallaght to Airport LVIA (2010); Curraghgraigue Windfarm, Tipperary (2004-08) and a number of other national infrastructure and high profile commercial and residential projects.

11.2 Methodology

11.2.1 Terminology

Landscape impacts are defined as changes in the fabric, character and quality of the landscape as a result of the development. This includes direct impacts to landscape receptors and greater effects that can alter the wider distinctiveness of the landscape. Landscape receptors are the physical or natural resource, special interest or viewer group that will experience an impact. The sensitivity (of a landscape receptor) is the vulnerability to change. The extents of the landscape impacts have been assessed by professional evaluation using the terminology defined as per Tables 11.1, 11.3 and 11.4. The terminology is based on the criteria set down in the Guidelines for Landscape and Visual Impact Assessment (3rd Edition, by The Landscape Institute / Institute of Environmental Assessment published by E&FN Spon, 2013). Landscape impacts are assumed to be permanent.

Table 11.1 Extent of Landscape Impact

Imperceptible Effects	An effect capable of measurement but without noticeable consequences. There are no noticeable changes to landscape context, character or features.
Not significant	An effect which causes noticeable changes in the character of the landscape but without noticeable consequences. There are no appreciable changes to landscape context, character or features.
Slight Effects	An effect which causes noticeable changes in the character of the landscape without affecting its sensitivities. There are minor changes over a small proportion of the area or moderate changes in a localised area or changes that are reparable over time.
Moderate Effects	An effect that alters the character of the landscape in a manner that is consistent with existing and emerging trends. There are minor changes over some of the area (up to 30%) or moderate changes in a localised area.
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the landscape. There are notable changes in landscape characteristics over a substantial area (30-50%) or an intensive change over a more limited area
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment. There are notable changes in landscape characteristics over a substantial area (50-70%) or a very intensive change over a more limited area
Profound Effects	An effect which obliterates sensitive characteristics. There are notable changes in landscape characteristics over an extensive area (70-100%) or a very intensive change over a more limited area

Visual impacts relate solely to changes in available views of the landscape and the effects of those changes on people viewing the landscape. They include the direct impact of the development on views, the potential reaction of viewers, their location and number and the impact on visual amenity. The intensity of the visual impacts is assessed by professional evaluation using the terminology defined as per Tables 11.2, 11.3 and 11.4.

Table 11.2 Extent of Visual Impact

Imperceptible Effects	There are no changes to views in the visual landscape.
Not significant	An effect which causes noticeable changes in the character of the visual environment but without noticeable consequences. The proposal is adequately screened due to the existing landform, vegetation or constructed features.
Slight Effects	An effect which causes noticeable changes in the character of the visual environment without affecting its sensitivities. The affected view forms only a small element in the overall visual composition, or changes the view in a marginal manner.
Moderate Effects	An effect that alters the character of the visual environment in a manner that is consistent with existing and emerging trends. The proposal affects an appreciable segment of the overall visual composition, or there is an intrusion in the foreground of a view.

Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the visual environment. The proposal affects a large proportion of the overall visual composition, or views are so affected that they form a new element in the physical landscape.
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the visual environment. The proposal affects the majority of the overall visual composition, or views are so affected that they form a new element in the physical landscape.
Profound Effects	An effect which obliterates sensitive characteristics. The view is entirely altered, obscured or affected.

Table 11.3 Quality of the Landscape and Visual Impact

Neutral Impact	Neither detracts from nor enhances the landscape of the receiving environment or view
Positive Impact	Improves or enhances the landscape of the receiving environment or a particular view
Negative Impact	Detracts from the quality of the landscape or view

Table 11.4 The Duration of the Visual Impact

Temporary	Impacts lasting one year or less
Short-term	Impacts lasting one to seven years
Medium-term	Impacts lasting seven to twenty years
Long-term	Impacts lasting twenty to fifty years
Permanent	Impacts lasting over fifty years

The landscape and visual assessment methodology will be utilised in conjunction with a professional evaluation of the proposed development to determine the degree of impact.

The term 'study area' as used in this report refers to the site itself and its wider landscape context in the study of the physical landscape and landscape character. This may extend for approximately 1km in all directions from the site in order to achieve an understanding of the overall landscape. In terms of the visual assessment, the study of visual amenity may extend outside the study area, from areas where views of the site are available, but the majority of visual impacts for a development of this nature would be most significant within 500m.

11.2.2 Surveys and Guidelines

The methodology employed in the landscape and visual impact assessment is as follows:

1. Desktop survey of detailed maps, aerial photography and other information relevant to the study area, including the Waterford County Development Plan 2011-2017 and the Waterford City Development Plan 2013 - 2019. The Waterford North Quays Strategic Development Zone Planning Scheme 2018 and the Waterford North Quays - Urban Design Framework Plan have also been reviewed.

2. Site survey and photographic survey to determine landscape character of the general study area and specific landscape of the site.
3. Assessment of the potential significant impacts of the proposed development utilising the plan and elevation drawings of the proposed development to determine the main impacting features and the degree to which these elements would be visible in relation to observations made during the field survey. In determining visibility, the views to and from the proposed bridge are considered based on the heights, finishes, design and other visual characteristics of the proposed structures and setting. Photomontages have also been prepared from two viewpoints to give a visual representation of the proposals from near the Ard Rí Hotel and from Dock Road. The photomontages are presented in Figure 11.2 in Volume 3 of this EIAR. Photomontages are used as a tool to come to understand the nature of potential effects and to assist the determination of the magnitude and significance of residual landscape and visual effects.
4. The proposal of a scheme of mitigation measures, where relevant. These will be defined as measures which will be generally implemented and specific landscape measures which would be site-specific and address particular landscape or visual issues identified.
5. An evaluation of the impacts of the proposed development with and without amelioration. For the purposes of assessment, the predicted visual effects of the proposed development are assumed at 10 years following the completion of the proposed development.

The assessment follows prescribed methodologies, as set down in the following publications:

1. Guidelines for Landscape and Visual Impact Assessment 3rd Edition, by The Landscape Institute / Institute of Environmental Assessment published by E&FN Spon (2013),
2. Advice notes on Current Practice in the Preparation of Environmental Impact Statements, published by the Environmental Protection Agency (EPA) (2003), and
3. Guidelines on the information to be contained in environmental impact statements, published by the EPA (2002).

The Draft EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) EPA, 2017 was also consulted.

11.3 Receiving Environment

11.3.1 Site Setting/Landscape Character

The site of the proposed bridge spans from Waterford's North Quays to the South Quays where it will land on Meagher's Quay near the Clock Tower. This is a city centre site, with a strong urban character on the south side. The buildings facing onto the south quays are generally commercial and of 3 to 4-storey height, occasionally reaching 6-storey.

The northern side was an industrialised port until the 1990s and is now predominantly disused and semi-derelict in visual terms. The disused industrial buildings and wharves have been demolished. Rail lines remain on the waterfront, with a dual carriageway road (Dock Road) above retaining walls to the north, with the land rising steeply up from the river level. Residential developments of a suburban character are located to the north and east of the North Quays, and Waterford (Plunkett) Railway

Station is located to the west of the North Quays SDZ lands. These developments are elevated above Dock Road and the North Quay.

At present there is one bridge crossing of the River Suir in Waterford City, Rice Bridge, located some 550m to the west of the proposed bridge site. Rice Bridge is approximately 18m wide, with two lanes of traffic in each direction and a footpath in each direction. There are eight bridge piers, two of which are particularly large. The bridge has a low, metal balustrade, c.1.2m in height.

11.3.2 Landscape Planning Context

The landscape planning context for the area is set down in the Waterford County Development Plan 2011-2017 and the Waterford City Development Plan 2013 – 2019. The Waterford North Quays Strategic Development Zone Planning Scheme 2018 and Waterford North Quays - Urban Design Framework Plan also sets out several policies relevant to the landscape and visual assessment of the proposed bridge.

Chapter 8 Environment and Heritage of the Waterford County Development Plan 2011-2017 sets out policies with regard to the landscape of the county. Section 8.1 Landscape states:

> The *management of the County's landscape involves:*
>
> - *Sustaining and conserving the landscape;*
> - *Protecting the landscape from inappropriate and unsustainable development;*
> - *Providing for development that will enhance and benefit the receiving environment; and*
> - *Ensuring adequate protection to sensitive and vulnerable landscapes through appropriate policies and objectives.*

Appendix A9 Scenic Landscape Evaluation to the Waterford County Development Plan 2011-2017 considers that Waterford City is in an area designated as "Robust"; i.e. "areas of concentrated existing development and infrastructure". It states that: "Appropriate new development in these areas can reinforce the existing desirable landuse patterns. The overall aim is to ensure that the inherent character of the town and village centres is maintained."

The Waterford City Development Plan 2013-2019 notes the importance of the Quays as a waterfront: "The width of the river, the length of the Quays, their uniformity and the activities along the South Quays make for an element of major visual and townscape importance". The development of a footbridge is considered desirable in the Waterford City Development Plan 2013-2019 under Objective 6.2.1 "To expand the network to connect the city centre to any proposed North Quay development with a foot/cycle bridge". The Waterford City Development Plan 2013-2019 outlines the need for pedestrian access to the North Quays and also supports the development of the North Quays.

The Waterford North Quays - Urban Design Framework Plan also includes for the development of a new bridge to connect the North and South Quays. It also sets out a series of "Significant Vistas" which are to be maintained and enhanced. These views usually terminate in a view of a significant focal element, e.g. monument or listed building – Reginald's Tower, Christ Church Cathedral, the Clock Tower (South Quays) and Sion Hill House (Ferrybank, north of North Quays).

The Waterford North Quays Strategic Development Zone Planning Scheme 2018 (SDZPS) summarises the existing significant views as identified in previous plans for the North Quays in Section 4.5 as follows:

South to North

(A) Bridge Street

(B) Barronstrand Street

(C) The Mall

(D) Panoramic view from South Quays to North Quays

North to South

(E) Western approach to Rice bridge

(F) Rockshire Road

(G) Panoramic view from North Quays to South Quays

It is generally recognised that the most significant views are those generally available from the north to the south and vice versa from any point on the river's edge. It is the objective of the Planning Scheme that these views will be retained as the defining views of the City.

Views B, D, E and G are most relevant to this study as they include views of the site of the proposed bridge. Plate 11.1 illustrates the location of the views and is taken from Figure 25 of the SDZPS.

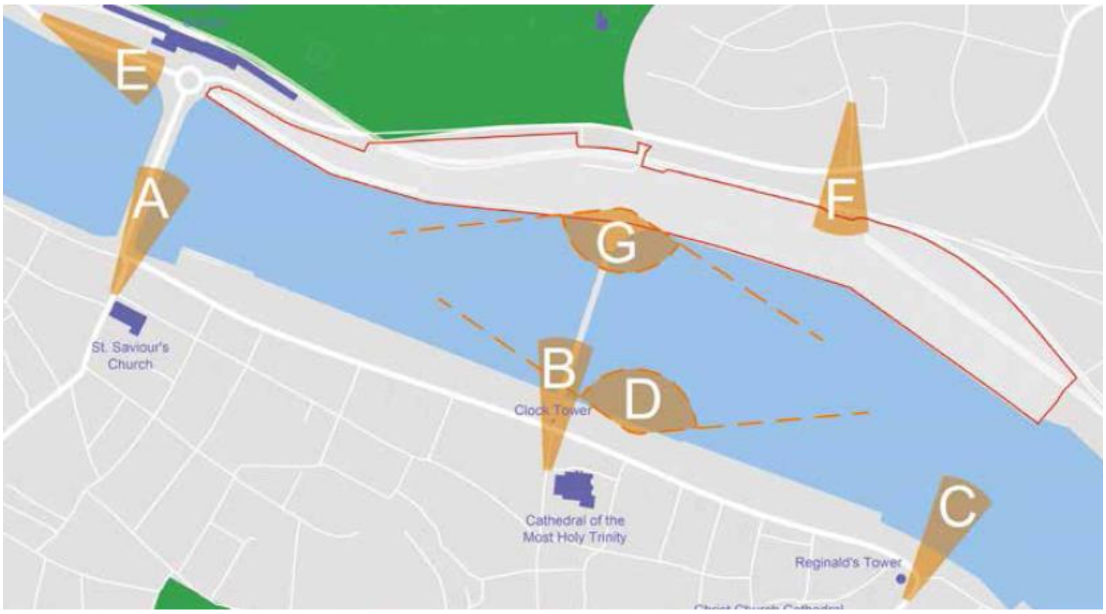


Plate 11.1 Figure 25 of the SDZPS – Views to be retained

11.3.3 Description of Site

The site of the proposed bridge spans the River Suir and connects the North Quays to Waterford City Centre at Meagher's Quay on the South Quays. The river is the main feature of the landscape and is approximately 200m wide at this point. Both banks are urbanised wharves, with no soft riparian edges or vegetation present. The river flows eastwards for approximately 7.5km, where it joins with the River Barrow and flows out into Waterford Harbour.

The North Quays are currently semi-derelict and disused. The landscape is composed of industrial-scale wharves, a railway line and Dock Road (R711). Dock Road is estimated to be elevated above the level of the wharf by some 8-10m. There are residential buildings to the north which face onto Dock Road with a single storey elevation and 2-3 storey residential properties to the rear of Dock Road, facing onto the wharf. There has been an extensive programme of demolition on the North Quays in recent years resulting in the presence of spoil heaps and large areas of open space and hard standing on the wharves. As a result, the visual quality of the existing space is poor.

The natural topography rises up at Mountmisery and Mount Sion to the north and creates a ridgeline which is quite heavily wooded limiting views to the north. There are several prominent buildings and residential developments on the elevated ground overlooking the site from the north and north-east. Most notable of these is Sion Hill House, a listed building which is prominent in views from the south quays and the former Ard Rí Hotel to the north-west of the site.

Meagher's Quay on the south of the river is the location of the southern landing of the proposed bridge. The south quays are currently in use for car parking. The R680 regional road along Meagher's Quay comprises one lane of traffic in each direction, footpaths in each direction, a cycle lane in each direction and bus-stop/car parking zones. The R680 runs between the car parks on the South Quay and the buildings. The buildings on the South Quay are generally 4-storey, although the Granville Hotel on Meagher's Quay reaches 6 storeys. The buildings are characterful and have a Victorian character in general. An elevated riverside walkway with glass flood defence provides an amenity route with clear views of the river and quays for pedestrians. A series of marinas line the south quays, adding to the riparian character.

Barronstrand Street leads from the city centre to the quay and there is a Clock Tower at this junction with Meagher's Quay and Coal Quay. The Clock Tower dates from 1863 and was originally known as the Fountain Clock due to the horse troughs built into the design. The clock tower and buildings on the quays create a vibrant and characterful visual environment, although the car parking detracts from this somewhat.

Plate 11.2 View from Barronstrand Street to South Quays with Clock Tower and North Quays to rear. Sion Hill House is elevated on the hillside in the background. (View B from Plate 11.1)

Plate 11.3 **View from Meagher's Quay north along the route of the proposed bridge towards the North Quays, showing derelict industrial building on wharf to right of photo, with the former Ard Rí Hotel (left horizon) and Sion Hill House (centre) on Mount Sion to the rear. Housing developments in the Ferrybank neighbourhood are also visible in the right background. (View B from Plate 11.1)**

Plate 11.4 **Typical view along the South Quays, looking west from Coal Quay. (View D from Plate 11.1)**

Plate 11.5 **View from Dock Road looking east showing the river, quays, disused railway, and buildings on the North Quays. The spire of Christ Church Cathedral and the top of Reginald's Tower are visible on the city skyline. (View E from Plate 11.1; note – taken from location east of Rice Bridge)**

Plate 11.6 **View from Dock Road looking towards the South Quays encompassing the route of the proposed bridge. Christ Church Cathedral is visible on the left of the photo. (View G from Plate 11.1)**

Plate 11.7 View from Fountain Street, Ferrybank looking south-west towards the site of the bridge and city centre.

Plate 11.8 View from Rockshire Road looking south towards the city centre and Christ Church Cathedral / Reginalds Tower. (View F from Plate 11.1) Note that the site is not visible.

11.3.4 Views

Views of the site for the bridge are available from the following locations in the public realm:

- Barronstrand Street (View B in SDZPS, Figure 25 – see Plate 11.1 above; and photo in Plate 11.2)
- Panoramic view from South Quays to North Quays (View D in SDZPS, Figure 25; Plates 11.3 and 11.4)
- Western approach to Rice Bridge (View E in SDZPS, Figure 25; Plate 11.5)

- Panoramic view from North Quays to South Quays (View G in SDZPS, Figure 25; Plate 11.6) [Note that this area is not currently in the public realm, but is considered as such for the purposes of this study, as it will be publicly accessible in the future.]

Open views of the proposed bridge will also be available from Rice Bridge c.550m to the west, with the skyline of the city and Ferrybank as well as the trees of Estuary Wood, east of the proposed bridge location, forming the context and backdrop.

Views from Dock Road will be available only in certain locations near the proposed bridge (Plates 11.5 and 11.6) but in general the views are limited or blocked by the wall along the southern edge of the road and the elevational difference between the road and the wharf. Views from elevated areas of Fountain Street (continuation north east of Dock Road) are also potentially available, from a distance of more than 300m from the site (Plate 11.7).

Views from elevated residential receptors to the north of the site, looking south are also available; most notably from Sion Hill House and houses on the southern fringes of the Bishopsgrove residential estate.

11.3.5 Sensitivity of the Identified Receptors

In landscape terms, the sites of the proposed bridge landings, composed of hard standing to the north and car park to the south, are considered to have low sensitivity at the edge of the river. However, on the south quays, the presence of the Clock Tower increases the level of sensitivity of the landscape to moderate as this is an important landmark and architectural element in the cityscape. Rivers would usually be considered of high sensitivity as inherently attractive and important elements in the landscape. In this context, the focus of views is generally the skyline of the city centre, but the river contributes strongly to the amenity value of the views. The river is considered to have moderate sensitivity as it is very wide and flat at this point (c.200m) with a high visual robustness value due to scale of the river and the urban context.

Visual receptors have greater potential sensitivity to change in the landscape, however this is reduced by the following existing adverse factors:

- Low visual value of the existing North Quays;
- There are visual barriers for many potential receptors, including walls, trees, etc. which limit views of the site;
- The site of the bridge is slender and very small in comparison with the scale of the river in this context.

Sensitivity of visual receptors is therefore considered to be moderate for residential and public realm receptors with views of the site of the bridge.

11.4 Visual Characteristics of the Proposed Development

The proposed development comprises a bridge which will connect the North Quays to Waterford City Centre at Meagher's Quay across the River Suir in line with Barronstrand Street and the Clock Tower. The bridge has a span of approximately 207m and will be suitable for use by pedestrians, cyclists and an electric vehicle for transporting approximately 12-15 people across the bridge. An opening section will be provided to permit river traffic to pass up and downstream as required, see Figure 11.3 of Volume 3 of this EIAR. As this is a multispan bridge, piers will be required to be built within the River Suir.

The bridge has an overall visible depth (including parapets) in elevation of approximately 1.9 - 3m, including at some locations (depending on location) a 1.4m-high parapet / wind shield which will be provided throughout the bridge for safety and shelter. The bridge includes two resting/viewing points with seating and shelters. The highest point of the deck will be at the bridge approach on the North Quay (+8.0mOD at the top of pavement level), compared with +4.2mOD on the south quays. The colour of the bridge is a matter for detailed design but is likely to be a light colour, potentially white or off-white.

The proposed bridge has an internal width of 8 metres and an overall width of approximately 9.0m. The width of the bridge deck is constant over the bridge extents with the exception of the portions over the two central pier support locations where resting/viewing points have been introduced and the bridge widens out locally over the arches. These are asymmetrical in form, with one facing northwest towards Rice Bridge and the other looking south-east towards the quays and estuary downriver. There is also a deck splay incorporated near the ends of the bridge at both north and south, where the width of the bridge widens to c.16m in the final 14-19m on both sides. At both bridge ends, the deck will terminate at the commencement of the approach splays.

The five span bridge deck has been laid out symmetrically and comprises a 70m long central span (32.5m wide opening section with a 25m wide navigable channel), two intermediate spans of 41m and two end spans of 27.5m length. There are four piers in total. This provides a symmetrical arrangement across the river channel. The opening section of the central span is detailed as a counterweighted, hydraulically operated twin leaf bascule with all hydraulics located within the depth of the bridge deck.

In terms of structure, the bridge deck is of steel construction. On the south side, the deck will have a half through configuration (U shaped) consisting of a shallow box girder over the 8m wide bridge (depth approximately 600mm) connecting to two main edge box girders (varying depth between 1.6m to 0.9m deep) on either side protruding above the top of footway level. A parapet / wind shield of minimum 1.4m high is provided throughout. At the central piers location, two v-shaped steel legs (struts), connected over each pier, will support the deck. The legs have a box section to provide adequate stiffness without excessively increasing the loads in the foundation.

The bridge landing at both the north and south quays will be behind the existing wharf edge and quay wall respectively. On the south quays, a section of the existing glass panel flood walls will be removed and reinstated to tie into the proposed bridge abutment wall and parapets. A new space is proposed with extensive paved and planted spaces to address the existing streetscape around the Clock Tower and the South Quays. The South Quays will also contain the plant rooms / building for the south bascule, this building will be of the order of 5m x 10m plan area as presented in Figures 4.6 and 4.12 of Volume 3 of this EIAR. The ground level will rise slightly along the quay to allow for the courtesy vehicle to move through the space. There will also be lighting and street furniture. Design of the landing space at the North Quays landing will be determined by the future development of the North Quays, in accordance with the SDZPS, but it can be presumed that it will be of high quality materials and design to complement the bridge design.

A durable, energy-efficient illumination solution which provides a safe and well-lit environment for pedestrians, cyclists and electric bus users is proposed for the bridge. Integrated rail lighting units are proposed along the bridge. In addition, architectural lighting and in-ground up-lighters are proposed at the bridge approaches to complete the lighting solution.

In the water below the central portion of the bridge will be a ship impact protection system, comprising of posts with fenders attached.

See Plate 11.9 for an artist's impression of the proposed bridge and landing space on the South Quays, showing the context of the Clock Tower and the proposed South Quay plaza.

Plate 11.9 Artist's impressions of the proposed bridge and landing space on the South Quays

11.5 Potential Impacts

Potential landscape and visual impacts are effects created by the development that have an appreciable impact, positive or negative, on the existing landscape or on views of the landscape from sensitive receptors. Mitigation measures are not considered in the calculation of potential impacts.

For the purposes of evaluating potential impacts, the effects generated by the proposed bridge are assumed to be negative due to the change in the landscape.

11.5.1 Construction Phase

There will be moderate temporary negative impacts associated with the construction works of this development on the south quays and on the river itself. This will be due to the presence of construction equipment and building processes required to erect the proposed bridge, which will include cofferdams, piling rigs, cranes and other plant and machinery that will contrast with the existing landscape, particularly within the river and adjacent to the Clock Tower and buildings on the quays. The landscape of the north quays is not currently of significant landscape value but will undergo a temporary change from that of an area of waste ground to a construction site.

Visual impacts during construction will affect all sensitive receptors identified in section 11.3.5 above. The effects on the receptors during construction will be associated with the visibility of the construction activities, cofferdams, piling rigs, cranes and other plant and machinery that will be taller than the proposed bridge and will be very visible within the river and in views from the quays. Some of the construction equipment is likely to impact on the skyline of the city temporarily, particularly in views from the North Quays. However, due to the scale of the river and the relatively small construction site, the machinery will not dominate any view. The visual impacts are considered to be moderate and negative short term effects for all receptors during construction.

11.5.2 Operational Phase

11.5.2.1 Potential Landscape Impact

Following construction, the main landscape impacts of the proposed development are associated with the addition of the bridge landings on the quays and the new structure in the river. The impacts on the quays are considered to be positive as the new pedestrianised open spaces will displace car parking on the south quays and waste ground on the north. The level of impact on the south quays is considered to be significant and positive as the proposed public open space is considered to be a more appropriate setting for the Clock Tower and displaces existing car parking, which is somewhat unsightly. The proposed plant building will be small in scale and finished to a high quality specification in agreement with the Waterford City & County Council's Architects Department.

On the North Quays, as the extent and type of treatment is generally unknown at this time, the impact is considered to be potentially slight and positive. The bridge will open up and facilitate future development of this currently derelict site (in accordance with the SDZPS). Therefore it is likely that further positive effects will manifest as a result of this development.

The impact on the river is considered to be slight to moderate in extent and could be considered a potential negative landscape impact. This is due to the presence of a new man-made element in the river.

11.5.2.2 Potential Visual Impact

Potential visual impacts of the proposed development are assessed by examining specific views to and from the site of the proposed bridge. Visual impacts may arise where the proposed bridge or associated activities or elements change the existing visual environment. The most visible element is evidently the bridge itself, with its associated parapet, lighting, flagpoles and other elements. The proposed electric vehicle is of a small scale and is considered to generate marginally appreciable visual impacts as it shuttles back and forth over the bridge. The proposed South Quay plaza also results in changes to the visual landscape, which are considered to be positive as it creates a more varied and higher quality landscape facilitating views of the Clock Tower as a focal element in the landscape with heritage value.

Views into the site and from the site can be seen in the photos presented in Plates 11.2-11.8. These plates show key viewpoints from the surrounding area, which will be potentially affected by the proposed development. The following views are considered to be those which are likely to be considered most affected by the proposed bridge development.

V1: Views from Barronstrand Street (View B in SDZPS, Figure 25 – see Plate 11.1 above; and photo in Plate 11.2)

The proposed bridge will form a new element in the quayside landscape from this vantage point and will be visible behind the Clock Tower and framed by the buildings on Barronstrand Street and the South Quays. It will appear foreshortened due to the perspective, but from the slightly elevated viewpoint will be clearly visible. The impact of the bridge is considered to be moderate, permanent and potentially negative from this location. The new public open space surrounding the Clock Tower is considered to be a significant and positive potential impact, which may somewhat offset potential negative effects of the bridge.

V2: Panoramic view from South Quays to North Quays (View D in SDZPS, Figure 25; Plates 11.3 and 11.4)

The proposed bridge will be visible from all areas of the South Quays but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views from the quays with the backdrop of the rising topography with Sion Hill House and the former Ard Rí hotel remaining visible. The urban character of the receiving environment is not considered sensitive to change. The impact to the panoramic view (bearing in mind that the nature of a panoramic view takes in a wide sweep in all directions, some of which would be entirely unaffected) would be slight, permanent and potentially negative.

V3: Western approach to Rice bridge (View E in SDZPS, Figure 25) and View from Rice Bridge

The proposed bridge will be visible from Rice Bridge and the western approach but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views with the backdrop of the city skyline, Ferrybank and Estuary Wood. The impact to the views would be slight, permanent and potentially negative from this location, which is more than 500m from the proposed bridge.

V4: Panoramic view from North Quays to South Quays (View G in SDZPS, Figure 25; Plate 11.6)

The proposed bridge will be visible from all areas of the North Quays but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views from the quays with the backdrop of the cityscape rising behind, with the church spires and Reginald's Tower remaining visible. The impact to the view would be moderate, permanent and potentially negative. From this vantage point, at a distance of c.200m from the proposed bridge, the new public open space surrounding the Clock Tower is considered to be a moderate and positive potential impact, which may somewhat offset potential negative effects of the bridge.

V5: Views from Dock Road (Plates 11.5 and 11.6)

The proposed bridge will be visible from certain areas of Dock Road but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views from Dock Road with the backdrop of the cityscape rising behind, and the church spires and Reginald's Tower remaining visible. The viewpoints are elevated above the bridge and the impact to the view would be slight, permanent and potentially negative.

V6: Views from elevated areas of Fountain Street (Plate 11.7)

The proposed bridge will be partially visible from certain areas of Fountain Street but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The viewpoints are elevated above the bridge and the impact to the view would be slight, permanent and potentially negative.

V7: Views from Sion Hill House & from houses on the southern fringes of the Bishopsgrove residential estate

There will be open views of the bridge from Sion Hill House, but due to the elevation of the house approximately 20m above the level of the bridge it will not interrupt any views of the cityscape or river landscape. Whilst the houses on the southern fringes of the Bishopsgrove residential estate are somewhat lower, they are still at least 10-15m above the bridge deck and the same would be true for them. Therefore the impact to the views would be slight, permanent and potentially negative. From this vantage point, at a distance of c.400m from the proposed development, the new public open space surrounding the Clock Tower is considered to be a slight and positive potential impact.

Note regarding Potential Night-time Impacts

As there is substantial existing lighting in the environs of the site and receptors, potential impacts due to proposed lighting are considered to have a marginal effect on the general visual environment for receptors. In views from north of the river, the city is in the backdrop of the views, which is fully lit at night and in views from the south, Dock Road and other areas are also lit by street lights. Thus, it is anticipated that this would be perceived as a slight impact in this context. The bridge, once architecturally lit, is likely to be perceived positively by most viewers as a focal element in the landscape at night, adding to the sense of place.

11.6 Proposed Mitigation Measures

The following recommendations are put forward to mitigate against the negative impacts mentioned above and to reinforce the positive impacts of the proposed development. Mitigation measures are proposed and considered only on the lands of the subject site.

11.6.1 Construction Phase

During the construction phase, the contractor will be required to erect opaque hoarding of a minimum 2.0 metres in height around the site compound and works area on the South Quays. The hoarding shall be a high gloss printed finish with information and graphics about the project or as agreed with Waterford City and County Council. The precise hoarding type shall be agreed with Waterford City and County Council prior to works commencing. Hours of construction activity will also be restricted in accordance with local authority guidance.

11.6.2 Operational Phase

The following design features of the proposed development are integral to the design, and were included as part of the stepwise refinement method of design where potential impacts were identified and offset in the design phase:

1. The design of the bridge is of a good quality in visual terms, with arched profile and good quality materials (steel, glass, concrete) and colouring should complement the existing environment. Intense colours should be avoided.

2. The bridge landing areas are designed to create high quality public spaces with paving, green space and walling. Some ornamental planting is also integrated into the design for the Meagher's Quay landing and within the South Quay plaza which will aid in addressing the sensitive context of the Clock Tower.
3. Lighting should not be focused onto the River Suir and lighting design should provide for low levels of lateral light spillage to avoid unwanted areas of illumination.

Thus, there are no proposed ameliorative, remedial or reductive measures that can be recommended by this assessment, other than to ensure that the proposals for the public open space on the south quays are implemented as part of the proposed development and that the north quays landing space is designed and constructed to a similarly high standard.

Monitoring and maintenance of the bridge and landscape will also be required to ensure that there is no deterioration in the quality of the proposed elements over time which could lead to greater levels of visual impact.

11.7 Residual Impacts

The residual impacts are the impacts that the development is most likely to have on the receiving environment having regard to the proposed mitigation measures.

11.7.1 Construction Phase

Predicted landscape impacts at construction stage are likely to be as per the potential impacts described in Section 11.5.1. The mitigation measures proposed will have no effect on construction stage landscape impacts, as the character of the space will change considerably. This is considered a slight temporary negative impact.

The proposed hoarding will slightly improve the negative effect on visual impact in views from nearby roads and pedestrian areas, notably on the South Quays. However, as the construction equipment will be higher than the hoarding, the predicted visual impacts will otherwise be as indicated in the potential impacts Section 11.5.1.

11.7.2 Operational Phase

In the potential impacts analysis (Section 11.5.2), it is assumed that the bridge will generate negative landscape and visual impact, in order to understand the worst case scenario. However, in considering residual impacts, it is considered important to acknowledge that the bridge could, in actuality, generate positive impacts. Due to the quality of design and materials of the proposed bridge, and the fact that bridges, both new and old, are often perceived positively in the landscape (e.g. N25 Thomas Francis Meagher Bridge, M1 Boyne Bridge, etc.), it is our considered opinion that the bridge will create a positive element in views of the River Suir and the cityscape. New views from the bridge will also be opened up to pedestrians and users of sustainable transport. It will also add to the pedestrian permeability of the city and therefore enhance the experience of the city's landscape.

11.7.2.1 Residual Landscape Impact

The landscape impacts due to the proposed development would overall be slight, permanent and positive due to the new connectivity and quality of the bridge which will enhance the character of the landscape. Considering the overall cumulative effects of the aspirations of the SDZPS, this positive effect is likely to increase with time as new buildings and public realm are constructed. The cohesive land use and pattern that would result and the new spaces introduced will be connected to the city centre by the proposed bridge.

11.7.2.2 Residual Visual Impact

The residual visual impacts are those that will persist following implementation and establishment of the proposed landscape measures (medium term). See Figure 11.1 in Volume 3 of this EIAR for a summary of the residual visual impacts.

V1: Views from Barronstrand Street (View B in SDZPS, Figure 25 – see Plate 11.1 above; and photo in Plate 11.2)

The proposed bridge will form a new element in the quayside landscape from this vantage point and will be visible behind the Clock Tower and framed by the buildings on Barronstrand Street and the South Quays. It will appear foreshortened due to the perspective, but from the slightly elevated viewpoint will be clearly visible. The residual impact is considered to be moderate, permanent and positive from this location. The new public open space surrounding the Clock Tower is considered to be a significant and positive impact.

V2: Panoramic view from South Quays to North Quays (View D in SDZPS, Figure 25; Plates 11.3 and 11.4)

The proposed bridge will be visible from all areas of the South Quays but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views from the quays with the backdrop of the rising topography with Sion Hill House and the former hotel remaining visible. The impact to the panoramic view (bearing in mind that the nature of a panoramic view takes in a wide sweep in all directions, some of which would be entirely unaffected) would be slight, permanent and positive.

V3: Western approach to Rice bridge (View E in SDZPS, Figure 25) and View from Rice Bridge

The proposed bridge will be visible from Rice Bridge and the western approach but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views with the backdrop of the city skyline, Ferrybank and Estuary Wood. The impact to the views would be slight, permanent and positive from this location, which is more than 500m from the proposed bridge. The South Quay plaza would also provide some additional trees in the view from this distance which would result in a positive impact.

V4: Panoramic view from North Quays to South Quays (View G in SDZPS, Figure 25; Plate 11.6)

The proposed bridge will be visible from all areas of the North Quays but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views from the quays with the backdrop of the cityscape rising behind, with the church spires and Reginald's Tower remaining visible. The impact to the view would be moderate, permanent and positive. From this vantage point, at a distance of c.200m from the proposed development, the new public open space surrounding the Clock Tower is considered to be a moderate and positive impact.

V5: Views from Dock Road (Plates 11.5 and 11.6)

The proposed bridge will be visible from certain areas of Dock Road but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The bridge will form a new feature in the views from

Dock Road with the backdrop of the cityscape rising behind, and the church spires and Reginald's Tower remaining visible. The viewpoints are elevated above the bridge and the impact to the view would be slight, permanent and positive.

V6: Views from elevated areas of Fountain Street (Plate 11.7)

The proposed bridge will be partially visible from certain areas of Fountain Street but will not dominate the views or break the skyline at any point, due to the relatively low elevation and narrow width of the bridge. The viewpoints are elevated above the bridge and the impact to the view would be slight, permanent and positive.

V7: Views from Sion Hill House & from houses on the southern fringes of the Bishopsgrove residential estate

There will be open views of the bridge from Sion Hill House, but due to the elevation of the house approximately 20m above the level of the bridge it will not interrupt any views of the cityscape or river landscape. Whilst the houses on the southern fringes of the Bishopsgrove residential estate are somewhat lower, they are still at least 10-15m above the bridge deck and the same would be true for them. Therefore the impact to the views would be slight, permanent and positive. From this vantage point, at a distance of c.400m, the new public open space surrounding the Clock Tower is considered to be a slight and positive impact.

11.7.3 'Do Nothing' Scenario

The do-nothing impact refers to the non-implementation of the proposed development. The primary effect of this would be that the impacts and effects identified would not directly occur. Without the proposed develop bridge, the regeneration of the North Quays and the positive impacts that are likely to occur in the landscape as a result would be less likely to happen. If this were the case, the likelihood is that the North Quay would continue to degenerate and could generate negative landscape and visual effects over time. Without the proposed bridge there will be restricted connectivity between the north and south side of the city and the city will not reach its full potential as the driver of regional economic growth, resulting in a negative impact for the city and region. The proposed plaza at the Clock Tower on the South Quays is also unlikely to occur and the current parking use would likely continue in the vicinity of the tower, which is considered inappropriate for such a landmark element and unsightly in visual terms.

11.7.4 'Worst Case' Scenario

The views selected for analysis are those from where the proposed development is most likely to be visible and so the analysis of impacts represents a worst case scenario.

Chapter 12
Noise and Vibration

ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 12 Noise and Vibration

12.1 Introduction

This chapter, prepared by AWN Consulting, presents an assessment of the impacts of the proposed River Suir Sustainable Transport Bridge in terms of noise and vibration of the local environment as defined in the following Environmental Protection Agency guidance documents:

- Advice Notes on Current Practice in the Preparation of EIS (2003);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports Draft August 2017; and
- Guidelines on the Information to be Contained in Environmental Impact Statements, 2002

The study has been undertaken using the following methodology:

- Baseline noise monitoring has been undertaken in the vicinity of the proposed Sustainable Transport Bridge in order to characterise the existing noise environment;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed Sustainable Transport Bridge;
- Predictive calculations have been performed for the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most sensitive locations surrounding the Sustainable Transport Bridge. A schedule of mitigation measures has been proposed to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed Sustainable Transport Bridge.

The following British Standards were also consulted when carrying out this assessment:

- BS 4142:2014 *Methods for Rating and Assessing Industrial and Commercial Sound*;
- BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2; and
- BS 8233:2014 *Guidance on Sound Insulation and Noise Reduction for Buildings*.

This chapter of the Environmental Impact Assessment Report (EIAR) has been prepared by Alistair Maclaurin from AWN Consulting. Alistair Maclaurin (Senior Acoustic Consultant) holds a B.Sc. and has completed the Institute of Acoustics Diploma. Alistair has some 6 years' experience as an acoustic consultant and is a Member of the Institute of Acoustics. He has extensive knowledge in construction noise having worked as a noise specialist on major infrastructure projects such as Dublin Airport Expansion, Bolands Quay redevelopment, Crossrail and Thames Tideway Tunnel. Additionally, he has undertaken various other environmental noise assessments for infrastructure developments and planning reports.

12.2 Description of the Receiving Environment

A baseline environmental noise survey was conducted in the vicinity of the proposed Sustainable Transport Bridge and within Waterford City in order to quantify the existing noise environment in the vicinity of the noise-sensitive locations that may be affected by the proposed development.

A baseline survey of vibration along the proposed development was not undertaken as existing levels in the vicinity of the proposed development are not expected to be of a magnitude sufficient to cause disturbance to people or structural damage to property. Furthermore, vibration was not perceptible at any of the noise survey locations.

12.2.1 Survey Periods

An attended noise survey was conducted at 3 locations on 15 March 2017 between 13:20 and 17:30 hours.

12.2.2 Measurement Locations

The measurement location descriptions are presented in Table 12.1 below and illustrated in Plate 12.1.

Table 12.1 Baseline Noise Monitoring Locations

Survey Location	Description
AN1	Outside the rear of residential property at Bishopsgrove
AN2	Outside rear of residential property at Sion Row (overlooking the River Suir)
AN3	Outside mixed commercial and residential property on Meagher's Quay

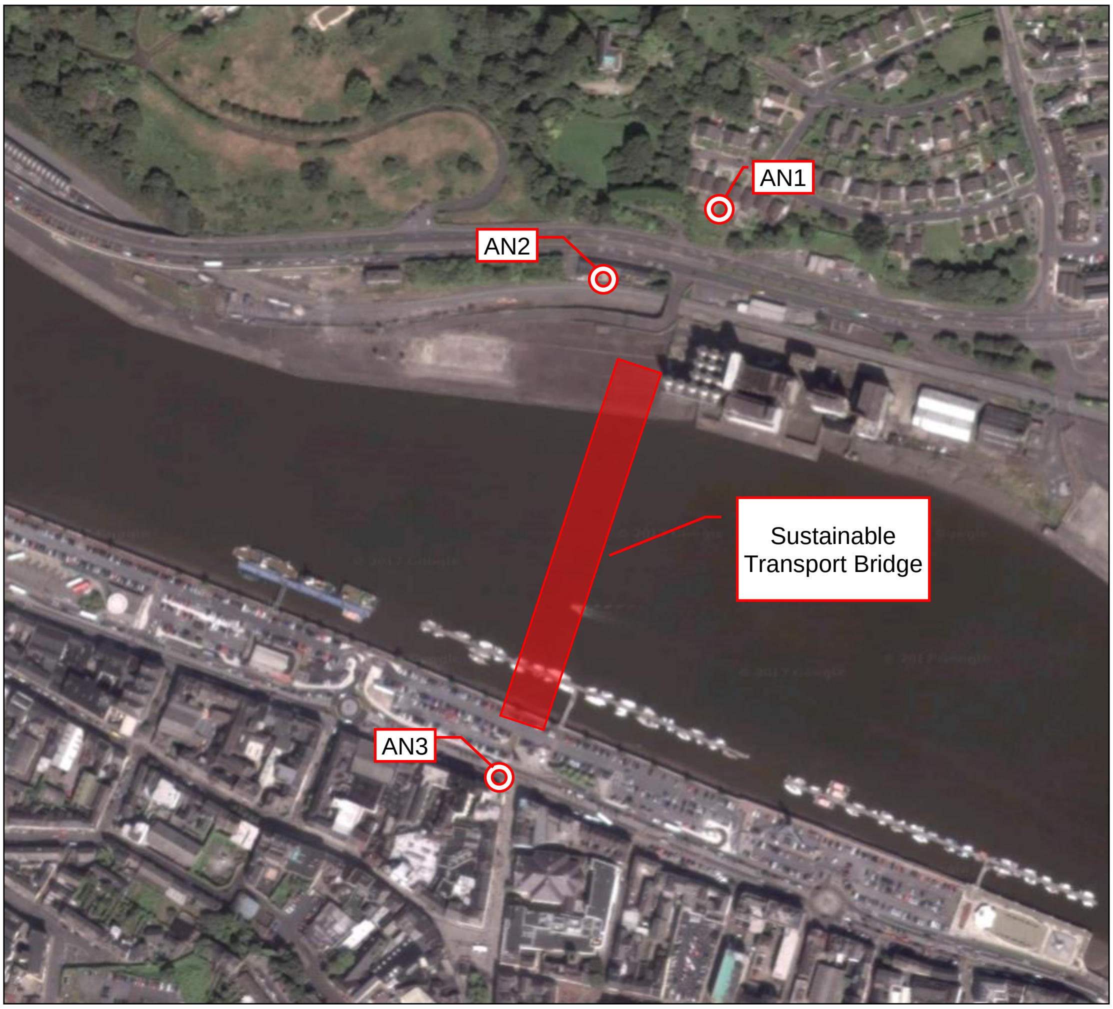


Plate 12.1 Baseline Noise Monitoring Locations

12.2.3 Instrumentation

The measurements were performed using a Brüel & Kjær Type 2250 Sound Level Meter. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

12.2.4 Procedure

Measurements were conducted on a cyclical basis at the locations noted above. Sample periods for the noise measurements were 15 minutes at each location with each location sampled three times. The results were noted onto an Environmental Noise Survey Record Sheet immediately following each sample, and were also saved to the instrument memory for later analysis where required. Survey personnel noted the primary noise sources contributing to noise build-up.

12.2.5 Weather

The weather during the survey period was mainly dry with mild temperatures in the range of 10 to 12°C for the duration of the survey and light winds. Towards the end of the survey, the sky became overcast and precipitation commenced at approximately 17:30 when measurements were halted.

12.2.6 Measurement Parameters

The noise survey results are presented in terms of the following five parameters:

$L_{Aeq, T}$ is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the period T. It is typically used as a descriptor for ambient noise.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

L_{Amin} is the instantaneous minimum sound level measured during the sample period.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2×10^{-5} Pa.

12.2.7 Results of Noise Surveys

Table 12.2 presents the results of the attended measured noise levels for each of the three survey locations.

The results of the survey have indicated that baseline noise levels at all locations assessed are dominated by existing traffic flows along the roads within Waterford City.

At location AN1 the noise climate was dominated by road traffic movements on Dock Road. Ambient noise levels were measured consistently at 71 dB L_{Aeq}. Background noise levels were in the range of 63 to 66 dB L_{A90}.

At location AN2 the noise climate was also dominated by road traffic movements on Dock Road. Ambient noise levels ranged from 59 to 61 dB L_{Aeq}. Background noise levels were in the range of 51 to 53 dB L_{A90}.

At location AN3 the noise climate was dominated by road traffic movements on Meagher's Quay. It was noted that there were regular movements of emergency vehicles with sirens on the road throughout the day. Ambient noise levels ranged from 67 to 74 dB L_{Aeq}. Background noise levels were in the range of 58 to 61 dB L_{A90}.

Table 12.2 Baseline Noise Monitoring Results

Survey Location	Start time	Measured Noise Levels (dB re.2x10^{-5}Pa)					Notes
		L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
AN1	15/03/2017 13:22	71	80	56	74	63	Free-field
	15/03/2017 14:50	71	81	56	75	64	
	15/03/2017 16:15	71	80	58	74	66	
AN2	15/03/2017 13:44	61	74	47	64	51	Façade
	15/03/2017 15:08	60	75	48	64	53	
	15/03/2017 16:34	59	76	48	63	52	
AN3	15/03/2017 14:16	69	84	54	73	61	Façade
	15/03/2017 15:41	74	102	52	70	58	
	15/03/2017 17:06	67	86	53	70	61	

12.3 Methodology

12.3.1 Construction Assessment Criteria

Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In lieu of statutory guidance, an assessment of significance has been undertaken as per British Standard *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise*.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 12.3 sets out the values which, when exceeded, signify a significant effect at the façades of residential receptors.

Table 12.3 Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,\,T}$)		
	Category A[A]	Category B[B]	Category C[C]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings and weekends [D]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

[D] 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined through a logarithmic averaging of the measurements for each location and then rounded to the nearest 5dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur. Table 12.4 presents the assigned *BS 5228-1:2009+A1:2014* categories and threshold values for each baseline location.

Table 12.4 Defined Construction Noise Thresholds

Survey Location	$L_{Aeq,\,12\,hr}$	Ambient Noise Level Rounded to Nearest 5 dB L_{Aeq}	BS 5228-1:2009+A1:2014 Category	Construction Noise Threshold Value (dB) ($L_{Aeq,\,T}$)
AN1*	74	75	C	75
AN2	60	60	A	65

Survey Location	$L_{Aeq, 12 hr}$	Ambient Noise Level Rounded to Nearest 5 dB L_{Aeq}	BS 5228-1:2009+A1:2014 Category	Construction Noise Threshold Value (dB) ($L_{Aeq, T}$)
AN3	71	70	C	75

*Note that the survey measurements for location AN1 were undertaken in free-field conditions. For the purpose of this assessment a 3 dB correction for façade reflections has been applied.

Vibration

In terms of vibration, *BS 5228-2:2009+A1:2014* recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (PPV) (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis, to use this lower value. Taking the above into consideration the vibration criteria in Table 12.5 are recommended.

Table 12.5 Defined Construction Vibration Thresholds for Structurally Sound Buildings

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:-		
Less than 15Hz	**15 to 40Hz**	**40Hz and above**
15 mm/s	20 mm/s	50 mm/s

Note that the above thresholds are specified for transient or intermittent vibrations. Some construction activities, such as piling, may give rise to continuous vibrations. In these instances the guidance recommends that the previously defined thresholds are reduced by at least 50%.

Furthermore, the Clock Tower on Meagher's Quay has been identified as a potentially vulnerable building. *BS 5228-2:2009+A1:2014* recommends that vibration thresholds at this location are reduced by a further 50%. Table 12.6 defines the criteria for vulnerable buildings or structures.

Table 12.6 Defined Construction Vibration Thresholds for Vulnerable Buildings and Structures

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:-		
Less than 15Hz	**15 to 40Hz**	**40Hz and above**
7.5 mm/s	10 mm/s	25 mm/s

12.3.2 Operational Assessment Criteria

Noise Levels Generally

The World Health Organisation (WHO) have published in October 2018 *Environmental Noise Guidelines for the European Region*. The objective of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

However, it should be noted that the WHO guideline values referred to here are recommended to serve as the basis for a policy-making process to allow evidence based public health orientated recommendations. They are not intended to be noise limits and the WHO document states the following regarding the implementation of the guidelines,

> *"The WHO guideline values are evidence-based public health-oriented recommendations. As such, they are recommended to serve as the basis for a policy-making process in which policy options are considered. In the policy decisions on reference values, such as noise limits for a possible standard or legislation, additional considerations – such as feasibility, costs, preferences and so on – feature in and can influence the ultimate value chosen as a noise limit. WHO acknowledges that implementing the guideline recommendations will require coordinated effort from ministries, public and private sectors and nongovernmental organizations, as well as possible input from international development and finance organizations. WHO will work with Member States and support the implementation process through its regional and country offices."*

It is therefore not intended to refer to the WHO guidelines in an absolute sense as part of this assessment and it will be a decision for national and local policy makers to adopt the WHO guidelines and propose noise limits for use.

The main potential source of outward noise is the operation of the bridge whilst opening and any further mechanical services that may be associated with it. Appropriate guidance on internal noise levels for dwellings is contained within BS 8233:2014 *Guidance on Sound Insulation and Noise Reduction for Buildings*. This British Standard sets out recommended noise limits for indoor ambient noise levels in dwellings as presented in Table 12.7:

Table 12.7 Recommended Indoor Ambient Noise Levels from BS 8233:2014

Typical situations	Design Range, $L_{Aeq,T}$ dB	
	Daytime LAeq,16hr (07:00 to 23:00hrs)	Night-time LAeq, 8hr (23:00 to 07:00hrs)
Living / Dining Rooms	35 - 40	n/a
Bedrooms	35	30

Plant Noise

In relation to external services plant noise, reference is made to BS 4142:2014 *Methods for Rating and Assessing Industrial and Commercial Sound*. This document describes methods for rating and assessing sound of an industrial and/or commercial nature to a residential receptor. The methods described in this standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The results of baseline surveys of the prevailing background sound level allow for the noise impact associated with proposed new external plant items to be assessed. With reference to BS 4142:2014, it is noted that, depending on context, adverse impacts are likely to occur when rated plant sound level exceeds the prevailing background sound level by +5dB, with a significant adverse impact occurring at +10dB or more. Where the rating level does not exceed the background sound level, BS 4142 comments that this is an indication of the specific sound source having a low impact, again depending on the context.

Vehicular Traffic

In order to assist with the interpretation of the noise associated with vehicular traffic on existing public roads, Table 12.8 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source Design Manual for Roads and Bridges (DMRB), 2011).

Table 12.8 Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level (dB L_{A10})	Subjective Reaction	Magnitude of Impact
0	Inaudible	No Impact
0.1 – 2.9	Barely Perceptible	Negligible
3 – 4.9	Perceptible	Minor
5 – 9.9	Up to a doubling of loudness	Moderate
10+	Doubling of loudness and above	Major

Table 12.8 presents the DMRB (2011) likely impacts associated with change in traffic noise level. The corresponding significance of impact presented in the '*EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EIAR), Draft, August 2017 is presented in Table 12.9 for consistency in wording and terminology for the assessment of impact significance.

Table 12.9 Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level DMRB, 2011 (dB L_{A10})	Subjective Reaction DMRB, 2011	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No change	None	Imperceptible
0.1 – 2.9	Barely perceptible	Minor	Not Significant
3.0 – 4.9	Noticeable	Moderate	Slight, Moderate
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial	Significant
10.0 or more	More than a doubling or halving of loudness	Major	Very Significant, Profound

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

12.4 Description of Potential Impacts

During the construction phase the main site activities will include site clearance, demolition, substructure and super structure construction. This phase will involve the use of various mobile plant, excavators, cranes, piling rigs, and other standard construction machinery throughout most of the site. Although it is expected that the demolition and substructure works are likely to give rise to noise and vibration emissions, the impact is considered relatively short-term in nature and is assessed in Section 12.4.1.

During the operational phase of the development, the potential sources of noise and vibration are limited to occasional use of mechanical plant required to operate the bridge opening mechanism and the movement of cyclists, pedestrians and an electric bus across the bridge. It is proposed to use plant rooms located on the north and south quays to open the bridge. These plant rooms will provide for a hydraulic power unit, a generator, a standby generator drive and programmable logic controller (PLC) units. The plant room required to open the southern bascule leaf will be located in a small building which will be located on the proposed footprint of the future building (west side of plaza). For the north quays, the plant room will be located in a room(s) located within the proposed future developments for the north quays. This building will be delivered as part of the SDZ development and is therefore not considered as part of this EIAR.

12.4.1 Construction Phase

Noise

The construction phase is expected to last a total of 18 – 24 months. Construction noise has been predicted at four noise sensitive locations. The locations are defined in Table 12.10 along with their associated baseline location and construction noise threshold. The receptor locations are presented in Plate 12.2.

Table 12.10 Defined Construction Noise Thresholds

Receptor	Receptor Address	Residential / Commercial	Applicable Baseline Ref	Construction Noise Threshold Value (dB) ($L_{Aeq, 12 hr}$)
R1	12 Bishopsgrove	Residential	AN1	75
R2	8 Sion Row	Residential	AN2	65
R3	72-73 Meagher's Quay	Commercial	AN3	75
R4	79 Meagher's Quay	Residential	AN3	75

Plate 12.2 Noise Sensitive Receptor Locations

A variety of items of plant will be in use for the purposes of site clearance and construction. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for the generation of elevated levels of noise.

During the construction phase, excavator mounted breakers will be employed to remove existing concrete and rock and then standard construction tools and methods will be employed for general construction and landscaping.

It is possible to predict indicative noise levels using guidance set out in *BS 5228-1:2009+A1:2014* for the main phases of the proposed construction works. The calculations assume common equipment used for each activity along with estimates of percentage on times for which the equipment will operate during the 12-hour working day. Table 12.11 summarises the construction noise prediction calculations at the nearest residences using the assumptions set out above for the worst-case day during each phase of construction.

Note that the predicted noise levels referred to in this section are indicative only and present the worst-case noise levels when construction works are occurring in close proximity to the sensitive locations. Construction noise levels will be lower than these levels for the majority of the time at the majority of properties in the vicinity of the proposed development.

Table 12.11 Indicative construction noise calculations at closest properties to works

Construction Plant	Data Source	Plant SWL dB	Percentage on Time	Calculated Construction Noise Levels, dB $L_{Aeq,12hr}$			
				R1	R2	R3	R4
Site Clearance & Removal of Glass Panels							
Excavator	BS 5228 (C2-21)	99	66	40	42	61	55
Excavator (loading)	BS 5228 (C2-30)	107	10	40	42	60	55
Lorry	BS 5228 (C2-34)	108	20	44	46	64	59
Generator	BS 5228 (C4-76)	89	100	32	34	52	47
Angle Grinder	BS 5228 (C4-93)	108	20	44	46	64	59
Hand-Tools (Based on Circular Saw)	BS 5228 (C4-72)	107	20	43	45	63	58
Total				50	51	70	65
Demolish North Site							
Excavator with Breaker	BS 5228 (C1-1)	120	66	70	75	64	64
Dumper	BS 5228 (C4-3)	104	66	54	59	48	48
Lorry	BS 5228 (C2-34)	108	20	53	58	47	47
Excavator (Loading)	BS 5228 (C2-30)	107	10	49	54	43	43
Total				70	75	64	64
Breakout Concrete South Bank							
Excavator with Breaker	BS 5228 (C1-1)	120	66	61	63	81	77
Dumper	BS 5228 (C4-3)	104	66	45	47	65	61
Lorry	BS 5228 (C2-34)	108	20	44	46	64	60
Excavator (Loading)	BS 5228 (C2-30)	107	66	48	50	68	64
Excavator	BS 5228 (C2-21)	99	66	40	42	60	56
Total				62	63	81	78
Driven Piles for South Quay Wall							
Bored Piling Rig	BS 5228 (C3-14)	111	66	53	54	70	67
Excavator	BS 5228 (C2-21)	99	66	41	42	58	55
Concrete Truck & Pump	BS 5228 (C4-28)	103	25	40	42	57	55

Construction Plant	Data Source	Plant SWL dB	Percentage on Time	Calculated Construction Noise Levels, dB $L_{Aeq,12hr}$			
				R1	R2	R3	R4
Generator	BS 5228 (C4-76)	89	100	33	34	49	47
Total				53	55	70	68
Pile Caps for South Quay Wall							
Angle Grinder	BS 5228 (C4-93)	108	25	45	47	62	60
Excavator With Breaker	BS 5228 (C1-1)	120	66	62	63	79	76
Concrete Truck & Pump	BS 5228 (C4-28)	103	25	40	42	57	55
Excavator	BS 5228 (C2-21)	99	66	41	42	58	55
Generator	BS 5228 (C4-76)	89	100	33	34	49	47
Total				62	64	79	76
Driven Piles North Abutment							
Bored Piling Rig	BS 5228 (C3-14)	111	66	61	66	55	55
Excavator	BS 5228 (C2-21)	99	66	49	54	43	43
Dumper	BS 5228 (C4-3)	104	66	54	59	48	48
Concrete Truck & Pump	BS 5228 (C4-28)	103	25	49	54	43	43
Generator	BS 5228 (C4-76)	89	100	41	46	35	35
Total				62	67	56	56
Pile Caps North Abutment							
Angle Grinder	BS 5228 (C4-93)	108	20	53	58	47	47
Excavator With Breaker	BS 5228 (C1-1)	120	66	70	75	64	64
Concrete Truck & Pump	BS 5228 (C4-28)	103	66	53	58	47	47
Excavator	BS 5228 (C2-21)	99	66	49	54	43	43
Dumper	BS 5228 (C4-3)	104	66	54	59	48	48
Total				70	75	64	64
Cofferdams Construction							
Vibratory Piling Rig	BS 5228 (C3-8)	116	66	62	65	66	65
Total				62	65	66	65

Construction Plant	Data Source	Plant SWL dB	Percentage on Time	Calculated Construction Noise Levels, dB $L_{Aeq,12hr}$			
				R1	R2	R3	R4
Driven Piles in River							
Driven Piles	BS 5228 (C3-3)	116	66	64	67	69	67
300T Crane	BS 5228 (C4-38)	106	66	54	57	59	57
Total				64	68	69	68
Pile Caps Construction In River							
Angle Grinder	BS 5228 (C4-93)	108	20	51	54	55	54
Excavator With Breaker	BS 5228 (C1-1)	120	66	59	62	64	62
Concrete Truck & Pump	BS 5228 (C4-28)	103	66	47	50	51	50
Excavator	BS 5228 (C2-21)	99	66	47	50	52	50
Dumper	BS 5228 (C4-3)	104	66	39	42	43	42
Total				60	63	65	64
Install Deck							
Angle Grinder	BS 5228 (C4-93)	108	20	51	54	55	54
Hand-Tools (Based on Circular Saw)	BS 5228 (C4-72)	107	20	50	53	54	53
300T Crane	BS 5228 (C4-38)	106	66	54	57	59	57
Driven Piles	BS 5228 (C3-3)	116	66	64	67	69	67
Concrete Truck & Pump	BS 5228 (C4-28)	103	25	47	50	51	50
Total				65	68	69	68
Install South Plaza							
Angle Grinder	BS 5228 (C4-93)	108	20	45	46	61	58
Hand-Tools (Based on Circular Saw)	BS 5228 (C4-72)	107	20	44	45	60	57
300T Crane	BS 5228 (C4-38)	106	66	48	49	64	61
Excavator	BS 5228 (C2-21)	99	66	41	42	57	54
Lorry	BS 5228 (C2-34)	108	66	50	51	66	63
Concrete Truck & Pump	BS 5228 (C4-28)	103	25	41	42	57	54
Total				54	55	70	67

The results of the assessment indicate that daytime construction thresholds are likely to be exceeded at locations R2, R3 and R4. The predicted exceedances are due to noise emissions from concrete breaking and piling activities. Note that whilst the entire programme of works is expected to last 18 – 24 months, individual activities such as breaking and piling will likely last for a smaller percentage of the entire programme (approximately 2-3 months) and as such these exceedances will not be occurring continuously throughout the construction phase. Piling is expected to take place at a range of distances from the sensitive receptors with the noisiest part of the piling process only occurring for a relatively short period in comparison with the entire programme.

Giving consideration to the predicted construction noise levels, it is recommended that the various best practice working methods used to control noise and vibration are adopted by the contractor during all works.

Vibration

The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works, piling activities, breaking operations and lorry movements on uneven road surfaces. The more significant of these is the vibration from piling and breaking operations; the method of which will be selected and controlled to ensure there is no likelihood of structural or even cosmetic damage to existing neighbouring dwellings.

Particular attention should be given to those items of equipment that may give rise to continuous vibrations. In the case of this project, those items are likely to be piling equipment. To this end empirical data has been selected from BS-5228-2 in order to identify whether there is potential for vibration emissions to impact on local receptors.

The sensitive receptor locations remain as defined in the construction noise assessment, however an additional receptor has been added to account for the Clock Tower on the South Quay which has been assumed to be a vulnerable building, in which case BS 5228-2 recommends that any vibration thresholds at this location are reduced by 50%. Plate 12.3 presents the location of the Clock Tower.

Plate 12.3 Clock Tower Location

It should be noted that the closest sensitive receptor (R3 in Plate 12.2) to the steel driven piling works is estimated to be at 50m distance, with the Clock Tower estimated to be approximately 25m distance from the steel driven piles located at the south abutment. In case a piling option is selected to prevent the settlements under the south plaza, Continuous Flight Auger (CFA) piles at suitable depth and spacing will be specified in order to avoid the excessive noise and vibrations in close proximity to the surrounding sensitive receptors. The advantage of selecting CFA piles is they are virtually vibration free and suitable for the soils and the type of development proposed on the South Quays.

Vibratory piling works will be carried out at the south abutment and at the sheet piling for the temporary cofferdams. The closest receptor to the vibratory piling works is estimated to be approximately 50m distance and the Clock Tower is estimated to be approximately 30m from the vibratory piling works.

Table 12.12 BS 5228-2 Empirical Vibration Data

BS 5228-2 Empirical Vibration Data		
Piling Type	**Distance (m)**	**Range of PPV**
Rotary Bored (BS 5228-2 D.6)	10	0.3 – 3.2 mm/s
Vibratory (BS 5228-2 D.10)	25	2.9 mm/s
Vibratory (BS 5228-2 D.10)	40	2.0 mm/s

As can be seen in Table 12.12, piling is not expected to emit vibrations that may cause building damage.

12.4.2 Operational Phase

Noise

There are four primary sources of operational noise that may be associated with the bridge:

- Plant servicing the bridge;
- Traffic on the bridge (electric shuttle bus);
- The bridge opening; and
- Plant room on the South Plaza.

The mechanical plant required to open the bridge will be controlled in accordance with BS 4142 such that the existing noise environment is not increased. Note that this applies to the plant required for normal operations, emergency or back-up plant such as the generator and related equipment will not be subject to the same noise limits.

Regarding traffic noise, a calculation has been undertaken to predict noise levels emitted by the electric bus that is proposed to run across the proposed bridge. For assessment purposes in calculating the noise emissions from the bus, it has been assumed that the bus will run approximately every 20 minutes between 8 am and 7 pm. To calculate the noise levels associated with this element of the proposed development a source SEL (sound exposure level) for a diesel bus has been taken from AWN's database of measured source noise levels to inform a road traffic calculation. It should be noted that a diesel bus is considered to emit a higher magnitude of noise than an electric bus. An electric bus will only generate tyre noise and there will be no engine noise associated with the proposed operation, therefore, this is a worst case assessment. The SEL has been used to calculate a 11 hour noise level at the closest receptors as a result of the bus operation alone. The results of the assessment are presented in Table 12.13.

Table 12.13 Baseline Noise Monitoring Locations

Receptor Ref	Bus SEL (dB)	Approximate Distance (m)	Calculated Noise Level (dB)	Baseline Noise Level (dB)	Resultant Change in Noise Level
R1	90	90	28	74	0
R2		25	33	59 - 61	0
R3		18	47	67 - 74	0

The results indicate that noise emissions due to the bus operation are multiple orders of magnitude below the existing baseline noise levels. It is predicted that the operation of the electric bus will be imperceptible.

Considering the measured existing noise levels and the perceived character of the existing noise environment (traffic related noise) it is expected that the operation of the Sustainable Transport Bridge will not generate noise or vibration emissions of significance such that the existing environment will be altered, this includes the movements of cyclists, the electric bus, pedestrians and the opening of the bridge.

It is considered that there will be a minor/not significant increase in noise levels at the receptors R3 and R4 however the as indicated previously as this is predicted to be of the order of 3 dB(A) it will be barely perceptible in the busy and receiving environment where the baseline noise levels of 67-74dB is dominated by vehicular traffic on the South Quays.

Vibration

It is considered vibration emissions from the operation of the Sustainable Transport Bridge will be imperceptible at all receptor locations.

12.5 Mitigation Measures

12.5.1 Construction Phase

Noise

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2. It is expected that the contractor will ensure that all best practice noise and vibration control methods will be used as necessary in order to ensure impacts to nearby residential noise sensitive locations are not significant. This will be particularly important during concrete breaking which is the activity forecast to have the highest potential noise impact. During concrete breaking, it is typical to screen the hydraulics with localised temporary barriers in order to break line of sight to the sensitive receptors. This may give up to a 10 dB reduction in noise levels which would bring noise levels into line with the previously defined thresholds for these activities.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;

- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- During construction, the contractor will manage the works to comply with noise limits outlined in *BS 5228-1:2009+A1 2014. Part 1 – Noise*;
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures;
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Establishing channels of communication between the contractor/developer, Waterford City and County Council and residents so that receptors are aware of the likely duration of activities likely to generate higher noise or vibration;
- The Contractor appointing a Site Environmental Manager (SEM) responsible for matters relating to noise and vibration; and
- Hydroacoustic monitoring will be undertaken for the full duration of the construction of the proposed development. This monitoring will establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) and more accurately characterise the sound outputs in terms of SPL and SEL at different frequencies arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be undertaken on a continuous basis for the duration of construction and the results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of good quality, printed site hoarding around the South Quays which will act as a noise barrier to general construction activity at ground level;
- Erection of barriers as necessary around items such as generators or high duty compressors; and
- Situate any noisy plant as far away from sensitive properties as permitted by site constraints.

Working Hours

Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:30hrs Saturday and Sunday. Works will not be undertaken outside these working hours without the written permission of Waterford City and County Council. Piling works will only be permitted between 08:00 to 18:00hrs Monday to Friday during the months of June, July, August, November, December and January.

Vibration

The Clock Tower will be equipped with the suitable monitoring equipment and instrumentation to closely monitor vibration levels in real-time during construction works in order to ensure compliance with the thresholds defined in Section 12.3.1 and Table 12.6. Should the specified vibration levels be exceeded works swill cease until an appropriate solution has been identified.

12.5.2 Operation Phase

No mitigation measures related to noise and vibration will be necessary during the operation of the proposed bridge and South Plaza as it is expected that it will not generate noise or vibration emissions of significance such that the existing noise or vibration environment will be altered. Furthermore, best practice guidelines will be adhered to by plant servicing the bridge. However, noise monitoring will be undertaken during the initial 6 month period following the opening of the bridge in accordance with the methodology outlined in BS4142 to determine that the existing baseline noise environment has not increased as a result of mechanical plant serving the development. In the event that an increase is measured, additional noise mitigation measures will be adopted.

12.6 Residual Impacts

12.6.1 Construction Phase

During the construction phase of the project there is the potential for impacts on nearby noise sensitive properties due to noise emissions from site activities. The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impacts will be reduced as far as is reasonably practicable. The resultant residual noise impact from this source will be of negative, moderate, short-term impact.

Table 12.14 Description of Construction Phase Effects

Quality	Significance	Duration
Negative	Moderate	Short-term

12.6.2 Operational Phase

During the operational phase it is expected that noise emissions from the Sustainable Transport Bridge will not be perceptible above the existing noise environment resulting in a neutral, imperceptible, long-term impact.

Table 12.15 Description of Construction Phase Effects

Quality	Significance	Duration
Neutral	Imperceptible	Long-term

12.7 Do-Nothing Scenario

In the event that the proposed development does not take place, the existing noise and vibration climate will remain unchanged on site and at nearby noise sensitive locations.

Chapter 13
Air Quality and Climate

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 13 Air Quality and Climate

13.1 Introduction

AWN Consulting were requested to assess the impacts on air quality and climate associated with both the construction and operational phases of the proposed River Suir Sustainable Transportation Bridge. The legislative air quality background of relevance to the proposed development is summarized below.

This chapter was completed Dr. Avril Challoner. She is a Senior Consultant in the Air Quality section of AWN Consulting. She holds a BEng (Hons) in Environmental Engineering from the National University of Ireland Galway, HDip in Statistics from Trinity College Dublin and has completed a PhD in Environmental Engineering (Air Quality) in Trinity College Dublin. She is a Member of the Institute of Air Quality Management and specialises in the fields of air quality, Environmental Impact Assessment (EIA) and air dispersion modelling.

13.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, National and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 13.1 and Appendix 13.1 Ambient Air Quality Standards).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the *Air Quality Standards Regulations 2011*, which incorporate *European Commission Directive 2008/50/EC* which has set limit values for the pollutants SO_2, NO_2, PM_{10}, benzene and CO (see Tables 13.1 - 13.2). *Council Directive 2008/50/EC* combines the previous *Air Quality Framework Directive (96/62/EC)* and its subsequent daughter directives (including *1999/30/EC* and *2000/69/EC*). Provisions were also made for the inclusion of new ambient limit values relating to particulate matter ($PM_{2.5}$) (see Appendix 13.1).

13.1.2 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in 1997 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, Ireland agreed to limit the net anthropogenic growth of the six greenhouse gases (GHGs) under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012 (ERM, 1998). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties (COP23) to the agreement was convened in Bonn, Germany in November 2017. The conference in Paris in 2015, COP21, was an important milestone in terms of international climate change agreements. The "Paris Agreement", agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions. The EU Effort Sharing Decision 406/2009/EC on GHG emissions requires Ireland to achieve a 20% reduction, relative to 2005 levels, by 2020 in GHG emissions for sectors of the economy not covered by the EU Emissions Trading Directive (i.e. non-Emissions Trading Scheme (ETS) GHG emissions). This is known as the EU 2020 Strategy.

2013 was the first year where the European Union's Effort Sharing Decision "EU 2020 Strategy" (Decision 406/2009/EC) was assessed. Ireland had non-ETS sectors emissions of 42.122 Mt CO_2 e.g. in 2013 when emissions covered by the EU's emissions trading scheme for stationary and aviation operators were removed.

The EU, on the 23rd/24th of October 2014, agreed the "*2030 Climate and Energy Policy Framework*" (EU, 2014). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

13.1.3 Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets, Ireland was obliged to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction) by 2010. In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% on 2005 levels), 65 kt for NO_X (49% reduction on 2005 levels), 43 kt for VOCs (25% reduction on 2005 levels), 108 kt for NH_3 (1% reduction on 2005 levels) and 10 kt for $PM_{2.5}$ (18% reduction on 2005 levels).

European Commission Directive 2001/81/EC on National Emission Ceilings for certain atmospheric pollutants prescribes the same emission limits as the 1999 Gothenburg Protocol. A national programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005 (DEHLG, 2004). Data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X (European Environment Agency (EEA), 2011). COM (Communication from the Commission) (2013) 920 Final is the "Proposal for a Directive on the reduction of national emissions of certain atmospheric pollutants and amending

Directive 2003/35/EC". The proposal will apply the 2010 National Emissions Ceiling Directive (NECD) limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, Non-Methane Volatile Organic Compounds (NMVOC), NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49% reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (83% below 2005 levels), for NO_X (75% reduction), for VOCs (32% reduction), for NH_3 (7% reduction), for $PM_{2.5}$ (35% reduction) and for CH_4 (7% reduction).

Table 13.1 EU Air Quality Standards (based on *European Commission Directive 2008/50/EC and S.I. 180 of 2011)*

Pollutant	Regulation Note1	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3 NO_2
		Annual limit for protection of human health	40 µg/m^3 NO_2
		Annual Critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3 PM_{10}
		Annual limit for protection of human health	40 µg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3 $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health	5 µg/m^3
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

13.2 Methodology

13.2.1 Local Air Quality Assessment

The air quality assessment was carried out following procedures described in the publications by the Environmental Protection Agency (EPA) (EPA 2002, 2003 and 2017) and using the methodology outlined in the policy and technical guidance notes, Local Air Quality Management Policy Guidance LAQM.PG(16) and Technical Guidance LAQM.TG(16), issued by UK Department for Environment, Food and Rural Affairs (UK DEFRA 2001, 2016a, 2016b; UK Department of the Environment, Transport and Roads 1998, UK Highways Agency 2007). The assessment of air quality is carried out using a phased approach as recommended by the UK Department for Environment, Food and Rural Affairs (UK DEFRA 2016a). The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of key pollutants will be carried out at sensitive receptors. These sensitive receptors have the potential to have an impact on the concentration of key pollutants due to the proposed development. An examination of recent EPA and Local Authority data in Ireland (EPA 2016, 2017) has indicated that SO_2 and smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential problems in regards to nitrogen dioxide (NO_2) and PM_{10} at busy junctions in urban centres (EPA 2016, 2017). Benzene, although previously reported at quite high levels in urban centres (EPA 2016, 2015), has recently been measured at several city centre locations to be well below the EU limit value (EPA 2016, 2017). Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres (EPA 2016, 2017). The key pollutants reviewed in the assessments are NO_2, PM_{10}, $PM_{2.5,}$ benzene and CO, with particular focus on NO_2 and PM_{10}.

Key pollutant concentrations are assessed for nearby sensitive receptors for the following scenarios:

- The Existing scenario (2017);
- Opening Year Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place (2019); and
- Opening Year Do-Something scenario (DS), which assumes the proposed development in place (2019).

The assessment methodology involved air dispersion modelling using the UK Design Manual for Roads and Bridges Screening Model (UK Highways Agency 2007) (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet (UK Department for Environment, Food and Rural Affairs, 2014) (Version 5.1), and following guidance issued by Transport Infrastructure Ireland (TII 2011), UK Highways Agency (UK Highways Agency 2007), UK Department for Environment, Food and Rural Affairs (UK DEFRA 2016a) and the EPA (EPA 2002, 2003, 2017).

Transport Infrastructure Ireland guidance states that the assessment must progress to detailed modelling if:

- Concentrations exceed 90% of the air quality limit values when assessed by the screening method; or
- Sensitive receptors exist within 50m of a complex road layout (e.g. grade separated junctions, hills etc).

The UK Design Manual for Roads and Bridges guidance (UK Highways Agency 2007), on which Transport Infrastructure Ireland guidance was based, states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 annual average daily traffic (AADT) or more;
- Heavy Goods Vehicles (HGVs) flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

Concentrations of key pollutants are calculated at sensitive receptors which have the potential to be affected by the proposed development. For road links which are deemed to be affected by the proposed development and within 200m of the chosen sensitive receptors, inputs to the air dispersion model consist of; road layouts, receptor locations, AADT, percentage heavy goods vehicles, annual average traffic speeds and background concentrations. The UK Design Manual for Roads and

Bridges guidance states that road links at a distance of greater than 200m from a sensitive receptor will not influence pollutant concentrations at the receptor. Using this input data, the model predicts the road traffic contribution to ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. The Design Manual for Roads and Bridges model uses conservative emission factors, the formulae for which are outlined in the Design Manual for Roads and Bridges Volume 11 Section 3 Part 1 – HA 207/07 Annexes B3 and B4. These worst-case road contributions are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case predicted ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the proposed development with these ambient air quality standards. Transport Infrastructure Ireland Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII 2011) detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. Transport Infrastructure Ireland significance criteria have been adopted for the proposed development and are detailed in Tables 13.2 to 13.4. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40 µg/m^3). However, the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purpose of this assessment.

Table 13.2 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No. days with PM_{10} concentration > 50 µg/m^3	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥4 µg/m^3	Increase / decrease >4 days	Increase / decrease ≥2.5 µg/m^3
Medium	Increase / decrease 2 - <4 µg/m^3	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m^3
Small	Increase / decrease 0.4 - <2 µg/m^3	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m^3
Imperceptible	Increase / decrease <0.4 µg/m^3	Increase / decrease <1 day	Increase / decrease <0.25 µg/m^3

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* - Transport Infrastructure Ireland (2011)

Table 13.3 Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Road Development			
Above Objective/Limit Value With Road Development (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Road Development (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Road Development (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Medium	Large
Well Below Objective/Limit Value With Road Development (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Road Development			
Above Objective/Limit Value With Road Development (≥40 µg/m³ of NO_2 or PM_{10}) (≥25 µg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Road Development (36 - <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Road Development (30 - <36 µg/m³ of NO_2 or PM_{10}) (18.75 - <22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Road Development (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* – Transport Infrastructure Ireland (2011)

Table 13.4 Air Quality Impact Significance Criteria For Changes to Number of Days with PM_{10} Concentration Greater than 50 µg/m³ at a Receptor

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Road Development			
Above Objective/Limit Value With Road Development (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Road Development (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Road Development (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Road Development (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Road Development			
Above Objective/Limit Value With Road Development (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Road Development (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Road Development (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Road Development (<26 days)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* – Transport Infrastructure Ireland (2011)

13.2.2 Ecological Sites

For routes which pass within 2km of a designated area of conservation (either Irish or European designation) Transport Infrastructure Ireland requires consultation with an Ecologist (TII, 2011). However, in practice the potential for impact to an ecological site is highest within 200m of the proposed scheme and when significant changes in AADT (>5%) occur.

Transport Infrastructure Ireland's Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev. 2, Transport Infrastructure Ireland, 2009) and Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (Department of the Environment, Heritage and Local Government, 2010) provide details regarding the legal protection of designated conservation areas.

If the assessment criteria of a designated area of conservation within 200m of the proposed development and a significant change in AADT flows are met, an assessment of the potential for impact due to nitrogen deposition should be assessed. The proposed development has the Lower River Suir Special Area of Conservation (SAC) designated site within its boundary. As this SAC is less than 200m from the site, an assessment is required if there is a traffic impact at the site.

13.3 Description of Existing Conditions

13.3.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (WHO 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

Johnstown Castle Meteorological Station in Co. Wexford is the most representative meteorological data location for the proposed River Suir Sustainable Transport Bridge. This meteorological station replaced the nearby Rosslare Meteorological Station in 2008 and has reported an average wind speed of 4.3 m/s with a south westerly prevailing wind. Historical data from Rosslare Meteorological Station indicates the prevailing wind speed and direction over the period 1978-2007 is south westerly in direction, with generally moderate wind speeds, averaging 5.7 m/s.

13.3.2 Trends in Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources (UK Highways Agency 2007). Thus, residential exposure is determined by the location of sensitive receptors relative to major road sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In 2011 the UK DEFRA published research (UK DEFRA 2011) on the long term trends in NO_2 and NO_x for roadside monitoring sites in the UK. This study marked a decrease in NO_2 concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this is that there now exists a gap between projected NO_2 concentrations which UK DEFRA previously published and monitored concentrations. The impact of this 'gap' is that the DMRB screening model can under-predict NO_2 concentrations for predicted future years. Subsequently, the UK Highways Agency (HA) published an Interim Advice Note (IAN 170/12) in order to correct the DMRB results for future years. There is a lack of similar modelling in Ireland, however in order to ensure conservative modelling, IAN 170/12 is also applied to the predictions for future years.

13.3.3 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2016" (EPA 2017), details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA 2018). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of other cities and large towns comprising Limerick, Galway, Waterford, Drogheda, Dundalk, Bray, Navan, Ennis, Tralee, Kilkenny, Carlow, Naas, Sligo, Newbridge, Mullingar, Wexford, Letterkenny, Athlone, Celbridge, Clonmel, Balbriggan, Greystones, Leixlip and Portlaoise. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D. In terms of air monitoring, the region of the proposed development is categorised as Zone C (EPA 2017).

Long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

With regard to NO_2, continuous monitoring data from the EPA in the Zone C monitoring stations of Kilkenny Seville Lodge and Portlaoise show that current levels of NO_2 are below both the annual and 1-hour limit values (see Table 13.5) with average long term annual mean concentrations ranging from 7 to 11 µg/m^3 in 2016. Based on these results, a conservative estimate of the background NO_2 concentration in the region of the River Suir Sustainable Transport Bridge development in 2018 is 11 µg/m^3.

Table 13.5: Annual Mean NO_2 Concentrations in Zone C Locations (2012-2016) (µg/m^3)

Station	Averaging Period	Year				
		2012	2013	2014	2015	2016
Kilkenny Seville Lodge	Annual Mean NO_2 (µg/m^3)	4	4	5	5	7
	Max 1-hr NO_2 (µg/m^3)	62	90	57	70	43
Portlaoise	Annual Mean NO_2 (µg/m^3)	-	-	16	10	11
	Max 1-hr NO_2 (µg/m^3)	-	-	74	84	36

In terms of CO, the average annual mean concentration in the Zone C locations of Portlaoise, Mullingar and Balbriggan for 2012 to 2016 was 0.43 mg/m^3. This is well below the limit value of 10 mg/m^3 (EPA 2016). 2014 to 2016 annual mean concentrations ranged from 0.4 – 0.5 mg/m^3. Based on this EPA data, a conservative estimate of the background carbon monoxide concentration in Waterford in 2018 is 0.43 mg/m^3.

In terms of benzene, the average annual mean concentration in the Zone C locations of Mullingar and Kilkenny for 2012 to 2016 was 0.28 µg/m^3. This is well below the limit value of 5 µg/m^3 (EPA 2016). 2013 to 2016 annual mean concentrations ranged from 0.09 – 0.5 µg/m^3. Based on this EPA data, a conservative estimate of the background benzene concentration in Waterford in 2018 is 0.7 µg/m^3.

Continuous PM_{10} monitoring carried out at the Zone C locations of Galway, Portlaoise and Ennis showed average long term annual mean concentrations of 11 – 21 µg/m^3, with at most 12 exceedances (in 2016 at Ennis) of the 24-hour limit value of 50 µg/m^3 (35 exceedances are permitted per year) (EPA 2016) (Table 13.6). Based on these results, a conservative estimate of the background PM_{10} concentration in the region of the River Suir Sustainable Transport Bridge development in 2018 is 17 µg/m^3.

Table 13.6: nnual Mean PM_{10} Concentrations in Zone C Locations (2012-2016) (µg/m^3)

Station	Averaging Period	Year				
		2012	2013	2014	2015	2016
Galway	Annual Mean (µg/m^3)	16	21	15	15	15
	24-hr Mean > 50 µg/m^3 (days)	1	11	0	2	3
Portlaoise	Annual Mean (µg/m^3)	-	-	12	12	17
	24-hr Mean > 50 µg/m^3 (days)	-	-	2	1	1
Ennis	Annual Mean (µg/m^3)	19	20	21	18	12
	24-hr Mean > 50 µg/m^3 (days)	8	8	8	10	12

Continuous $PM_{2.5}$ monitoring carried out at the Zone C location of Ennis, showed average levels of 7 - 16 µg/m^3 between 2012 and 2016. The annual average level measured in Ennis in 2016 was 8 µg/m^3, with an average $PM_{2.5}/PM_{10}$ ratio of 0.7. Based on this information, a ratio of 0.7 was used to generate a background $PM_{2.5}$ concentration in Waterford in 2018 of 12 µg/m^3.

13.4 Characteristics of the Proposed Development

The proposed development spans from Meagher's Quay on the South of the River Suir to the North Quays on the North of the river. The bridge is restricted to pedestrians, cyclists and an electric shuttle bus service. Therefore, there is no predicted impact, adverse or beneficial on traffic. Therefore, in accordance with the guidelines set out by TII and DMRB guidelines, no traffic assessment is required.

When considering a development of this nature, the potential air quality and climate impact on the surroundings must be considered for each of two distinct stages:

- Construction Phase; and
- Operational Phase

The primary sources of impacts from the proposed development occur in the construction phase of the project. These impacts are deemed to be due to construction related dust generation. As operational phase road traffic related to the project is expected to be an imperceptible source of emissions, the operational phase of the development is not predicted to generate significant impacts. Road traffic is also not expected to be a dominant source of greenhouse gas emissions resulting from the operational phase of the proposed development.

13.5 Predicted Impacts of the Proposed Development

13.5.1 Construction Phase: Air Quality

It is important to note that the predicted impacts associated with the construction phases of the proposed development are short term and temporary in nature. The Institute of Air Quality Management (IAQM) guidelines (IAQM 2014) for assessing the impact of dust emissions from construction and demolition activities were consulted based on the scale and nature of the works and the sensitivity of the area to dust impacts. In terms of receptor sensitivity, the area is characterised as having mostly medium sensitivity receptors with a small number of high sensitivity receptors within the area of the site. In terms of the south-westerly prevailing wind, the area downwind of the site is a high sensitivity environment (residential properties on Dock Road). However, as these receptors are situated up a hill from the proposed site, the potential impact is reduced.

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors. Construction activities such as excavation, earth moving and backfilling may generate quantities of dust, particularly in dry and windy weather conditions. While dust from construction activities tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. Vehicles transporting material to and from the site also have the potential to cause dust generation along the selected haul routes from the construction areas.

As shown in Table 13.7 below, the risk from dust soiling at the nearest sensitive receptor (a high sensitivity environment, distance < 50m) is considered medium under this guidance. The medium sensitivity receptors less than 50 metres from the site boundary are the numerous commercial buildings on the South Quay. As a result, the sensitivity of the area to dust soiling effects on people and property is **low** according to IAQM guidance (IAQM 2014).

Table 13.7 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

In addition, the IAQM guidelines also outline the assessment criteria for assessing the impact of PM_{10} emissions from construction activities based on the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected. The current PM_{10} concentration in Zone C locations as reported in Section 13.3.3 above is approximately 17 µg/m^3. As shown in Table 13.8 the worst-case sensitivity of the area to human health from PM_{10} (medium sensitivity, distance <50 m and with receptor numbers between 10 - 100) is considered **low** under this guidance.

Table 13.8: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)			
			<20	<50	<100	<200
High	< 24 µg/m^3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	< 24 µg/m^3	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	< 24 µg/m^3	>1	Low	Low	Low	Low

Construction dust has the potential to cause local impacts at ecologically sensitive areas. The proposed development is immediately adjacent to and within the River Suir SAC and therefore is a **high** sensitivity area. Dust can cause chemical changes to watercourses which may lead to the loss of plant or animal life due to a variety of reasons including changes in acidity. A project ecologist should assess the area for any additional risks.

Table 13.9: Sensitivity of the Area to Ecological Impacts

Sensitivity of Area	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

In order to determine the level of dust mitigation required during the proposed demolition and construction phases, the potential dust emission magnitude for each dust generating activity needs to be taken into account, along with the already established sensitivity of the area. These major dust generating activities are divided into four types to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

Demolition

There is no significant demolition associated with the proposed development with just removal of a section of the flood defence and marina and minor ground works at the South Quays. Therefore, there is no material demolition impact.

Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Dust emission magnitude from earthworks can be classified as small, medium and large and are described below.

- **Large:** Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8m in height, total material moved >100,000 tonnes;
- **Medium:** Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8m in height, total material moved 20,000 – 100,000 tonnes; and
- **Small:** Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

Due to the urban nature of the project, the site area is limited. The dust emission magnitude for the proposed earthwork activities can be classified as small. This results in an overall **negligible** risk of **temporary** dust soiling impacts, **low** risk of ecological impact and an overall **negligible** risk of **temporary** human health impacts as a result of the proposed earthworks activities as outlined in Table 13.10. Overall, in order to ensure that no dust nuisance occurs during the earthworks activities, a range of dust mitigation measures associated with a **low** risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Table 13.10 Risk of Dust Impacts - Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Construction

Dust emission magnitude from construction can be classified as small, medium and large and are described below.

- Large: Total building volume > 100,000m^3, on-site concrete batching, sandblasting;
- Medium: Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching; and
- Small: Total building volume < 25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as small. This results in an overall **negligible** risk of **temporary** dust soiling impacts, **negligible** risk of ecological impact and an overall **low** risk of **temporary** human health impacts as a result of the proposed construction activities as outlined in Table 13.11. Overall, in order to ensure that no dust nuisance occurs during the construction activities, a range of dust mitigation measures associated with a **low** risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Table 13.11 Risk of Dust Impacts - Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Trackout

The assessment of trackout accounts for the risk of dust being emitted as a result of dirt, mud or other debris from construction traffic, as they emerge from construction sites onto public roads. Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. Dust emission magnitude from trackout can be classified as small, medium and large and are described below.

- Large: > 50 Heavy-Duty Vehicle (HDV) (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100m;
- Medium: 10 - 50 HDV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100m; and
- Small: < 10 HDV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50m.

There is the potential that there will be unpaved road greater than 50m in length on the North Quays construction area. This area will also have between 10-50 HDVs movements per day. There will be no unpaved roads greater than 50m on the South Quays as site traffic will access the site compound directly off Meaghers Quay. This results in the dust emission magnitude from trackout activities to be classified as medium. This results in an overall **low** risk of **temporary** dust soiling impacts, **low** risk of ecological impact and an overall **low** risk of **temporary** human health impacts as a result of the proposed trackout activities as outlined in Table 13.12. Overall, in order to ensure that no dust nuisance occurs during the trackout activities, a range of dust mitigation measures associated with a medium risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Table 13.12 Risk of Dust Impacts - Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

The risk of dust impacts as a result of the proposed development are summarised in Table 13.13.

Table 13.13 Summary of Dust Risk to Define Site-Specific Mitigation

Potential Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Negligible Risk	Negligible Risk	Low Risk
Human Health	N/A	Negligible Risk	Negligible Risk	Low Risk
Ecological	N/A	Low Risk	Low Risk	Low Risk

13.5.2 Construction Phase: Climate

There is the potential for a number of greenhouse gas emissions to the atmosphere during the demolition and construction phases of the development. Greenhouse gas emitting sources such as construction vehicles, generators etc., have been considered and these may give rise to CO_2 and NO_2 emissions.

However, due to the nature of activities i.e. construction, CO_2 and NO_2 emissions will have a negligible impact on climate.

13.5.3 Operational Phase: Air Quality

The nature of the development is such that there is no predicted impact on traffic, beneficial or adverse. It is envisaged that there will be no change in AADT due to the proposed development. As detailed in the DMRB guidance, a quantitate air quality assessment is required under the following circumstances:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGVs flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

Therefore, using the DMRB screening criteria, no road links can be classed as 'affected' by the proposed development and do not require inclusion in the local air quality assessment.

13.5.4 Operational Phase: Climate

The nature of the development is such that there is no predicted impact on traffic, beneficial or adverse. It is envisaged that there will be no change in AADT due to the proposed development. Therefore, using the DMRB screening criteria listed above in Section 13.5.3, no road links can be classed as 'affected' by the proposed development and do not require inclusion in the regional climate assessment.

13.5.4.1 Do Nothing Impact

In the do nothing scenario there will be no construction or operational phase impacts. Ambient air quality concentrations are predicted to improve in future years, with a 3% decrease in background NO_2 concentrations predicted between 2017 and 2019. Reductions in PM_{10} and $PM_{2.5}$ are predicted to be less significant.

It is predicted that concentrations in the vicinity of the development will be less than 22% of the NO_2 annual mean limit value. Concentrations of PM_{10} and $PM_{2.5}$ are predicted to be 59% and 49% of the annual mean limits respectively. Benzene and carbon monoxide are predicted to be less than 10% and 6% of their respective limit values in 2017.

13.5.5 Air Quality Impacts on Sensitive Ecosystems

The EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") requires an Appropriate Assessment to be carried out where there is likely to be a significant impact upon a European protected site. Such sites include Special Areas of Conservation (SAC), Special Protection Areas (SPA), Sites of Community Interest (SCI), National Parks, Nature Reserves, Refuges for Fauna, Refuges for Flora, Wildfowl Sanctuaries, Ramsar Sites, Biogenetic Reserves and UNESCO Biosphere Reserves.

The TII guidelines state that as the potential impact of a development is limited to a local level, detailed consideration need only be given to roads where there is a significant change to traffic flows (>5%) and the designated site lies within 200m of the road centre line. While the River Suir SAC is within 200 m of the proposed development, there is no significant change in traffic flows, therefore, no further assessment is required for this development in terms of air quality.

13.6 Mitigation Measures

13.6.1 Construction Phase: Air Quality

A dust minimisation plan has been formulated for the construction phase of the project as construction activities are likely to generate some dust emissions. In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan, see Appendix 13.2. Provided the dust minimisation measures outlined in the plan are adhered to, the air quality impacts during the construction phase will be not be significant. Activities such as earthworks and the removal of hardstanding should be considered sensitive activities with respect to dust generation. In summary, the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic;
- Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions;
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities such as rock blasting or earthworks are necessary during dry or windy periods;
- Before entrance onto public roads, trucks will be adequately inspected to ensure there is no potential for dust emissions and will be cleaned as necessary; and
- The contractor will be required to erect opaque hoarding of a minimum 2.0 metres in height around the site compound and works area on the South Quays. The hoarding shall be a high gloss printed finish with information and graphics about the project or as agreed with Waterford City and County Council. The precise hoarding type shall be agreed with Waterford City and County Council prior to works commencing.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

When these dust minimisation measures and the dust minimisation plan are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

13.6.2 Construction Phase: Climate

Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to the short-term and temporary nature of these works, the impact on climate will not be significant.

13.6.3 Operational Phase: Air Quality

There is no significant impact predicted during the operational phase with respect to air quality. Therefore, no site-specific mitigation measures in relation to air quality are required during the operational phase of the proposed development. It is predicted that none will be required.

13.6.4 Operational Phase: Climate

The impact of the proposed development on climate will be imperceptible. Thus, no site-specific mitigation measures are required.

13.7 Conclusions

The Institute of Air Quality Management (IAQM) guidelines (IAQM 2014) for assessing the impact of dust emissions from construction and demolition activities based on the scale and nature of the works and the sensitivity of the area to dust impacts have been used in this assessment. In terms of receptor sensitivity, the area is characterised as having mostly medium sensitivity receptors with a small number of high sensitivity receptors within the area of the site. In terms of the south-westerly prevailing wind, the area downwind of the site is a high sensitivity environment (residential properties on Dock Road). However, as these receptors are situated up a hill from the proposed site the potential impact is reduced. The results of the construction phase air quality and climate assessment have shown that, with appropriate mitigation measures in place, residual impacts of the proposed development on air quality and climate for the long- and short-term result in negligible impacts.

The nature of the development is such that there is no significant predicted impact on traffic during the operational phase, beneficial or adverse. The bridge is restricted to pedestrians, cyclists and an electric shuttle bus service. Therefore, there is no predicted impact, adverse or beneficial on traffic. Therefore, in accordance with the guidelines set out by TII and DMRB guidelines, no traffic assessment is required as the impact on AADT due to the development is deemed to be imperceptible.

Therefore, the overall results of the air quality and climate assessment have shown that, with appropriate mitigation measures in place, short and long term residual air quality and climate impacts of the proposed development will be negligible.

13.8 References

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Appendix 13.1 Ambient Air Quality Standards

ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
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Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time. In response to the problem of acid rain, sulphur dioxide, and later nitrogen dioxide were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, was passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and does so every 12 months by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, details limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. This has also been passed into Irish Law under the Air Quality Standards Regulations 2011 (S.I. 180 of 2011). Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ is to establish a target value of 25 µg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m^3, as an annual average (to be attained everywhere by 2018), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m^3. Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008-2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 µg/m^3 has been set to be complied with by 2018, again based on the AEI.
Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert

Threshold is defined in Council Directive 2008/50/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 2008/50/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 2008/50/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 2008/50/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_x (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_x such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex III of EU Directive 2008/50/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 21 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Appendix 13.2
Dust Minimisation Plan

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Dust Minimisation Plan

A Dust Minimisation Plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with meteorological factors, including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within 200m of the construction area.

In order to ensure mitigation of the effects of dust nuisance, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate, dry sweeping of large areas should be avoided. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only. Given the nature of the development, it is unlikely any un-surfaced roads will be present. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions. All site fencing, barriers and scaffold should be kept clean using wet methods.

It is not expected that there will be any demolition activities associated with the construction phase. However, should demolition occur, explosive blasting should be avoided and water suppression should be used, preferably with a hand held spray. Only the use of cutting, grinding or sawing equipment fitted or used in conjunction with a suitable dust suppression technique such as water sprays/local extraction should be used. Drop heights from conveyors, loading shovels, hoppers and other loading equipment should be minimized. If necessary, fine water sprays should be employed.

Vehicles delivering material with dust potential to an off-site location shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust. Access gates are to be located at least 10 m from receptors where possible. Vehicles should have engines switched off when stationary i.e. no idling. Similarly, the use of diesel or petrol powered generators should be avoided and electricity or battery powered equipment should be used when practical.

Vehicles exiting the site will make use of a wheel wash facility where appropriate and prior to entering onto public roads must ensure mud and other wastes are not tracked onto public roads. Public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions. On-site haul routes will be inspected for integrity and necessary repairs to the surface will be instigated as soon as reasonably practicable. Record will be kept of all inspections of the haul routes and any subsequent action will be recorded in a site log book.

Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Sand and other aggregates will be stored in bunded areas and will not be allowed to dry out, unless this is required for a particular process, in which case it will be ensured that appropriate additional control measures are in place. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods, and activities such as scabbling should be avoided. Bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
At all times, the procedures put in place will be strictly monitored and assessed by the contractor. In the event of dust nuisance occurring outside the site boundary, satisfactory

procedures will be implemented to rectify the problem. Dust deposition monitoring should be put in place to ensure dust mitigation measures are controlling emissions. Dust monitoring should be conducted using the Bergerhoff method in accordance with the requirements of the German Standard Verein Deutscher Ingenieure (VDI) 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft (Technische Anleitung zur Reinhaltung der Luft) limit value is 350 mg/(m^2*day) during the monitoring period between 28-32 days.

The Dust Minimisation Plan will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. The name and contact details of a person to contact regarding air quality and dust issues should be displayed on the site boundary. This notice board should also include head/regional office contact details. Community engagement before works commence on site should be put in place, including a communications plan. A ll dust and air quality complaints should be recorded and causes identified, along with the measures taken to reduce emissions. This complaints log should be available for viewing by the local authority, if requested. Daily on and off-site inspections should occur for nuisance dust and compliance with the dust management plan. This should include regular dust soiling checks of surfaces such as street furniture, windows, and cars within 100m of the site boundary. Cleaning should be provided if necessary.

Chapter 14
Archaeological and Cultural Heritage

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Chapter 14 Archaeological and Cultural Heritage

14.1 Introduction

This chapter examines the potential impact on the archaeological and cultural heritage resource of the proposed bridge over the River Suir in Waterford city. The proposed bridge will join from the northern wharf to Meagher's Quay to the south. The assessment was carried out by Irish Archaeological Consultancy Ltd (Barry Fitzgibbon MA, MIAI), on behalf of Waterford City and County Council.

This study determines, as far as reasonably possible from existing records, the nature of the archaeological resource within the proposed development area using appropriate methods of study. In order to provide an appropriate archaeological context, the wider vicinity was also examined. Desk-based assessment is defined as a programme of study of the historic environment within a specified area or site that addresses agreed research and/or conservation objectives. It consists of an analysis of existing written, graphic, photographic and electronic information in order to identify the likely heritage assets, their interests and significance and the character of the study area, including appropriate consideration of the settings of heritage assets (CIfA 2014). This leads to the following:

- Determining the presence of known archaeological heritage sites that may be affected by the proposed development;
- Assessment of the likelihood of finding previously unrecorded archaeological remains during the construction programme; and
- Suggested mitigation measures based upon the results of the above research.

The assessment involved detailed interrogation of the archaeological, historical and architectural background of the development area. This included information from the Record of Monuments and Places (RMP) of County Waterford, the County and City Development Plans, the topographical files of the National Museum of Ireland and cartographic and documentary records. Aerial photographs of the assessment area held by Ordnance Survey Ireland were also consulted. A field inspection was carried out during March 2018 in an attempt to identify any known cultural heritage sites and previously unrecorded features, structures and portable finds within the study area.

An impact assessment and a mitigation strategy have been prepared. The impact assessment is undertaken to outline potential adverse impacts that the proposed bridge may have on the cultural heritage resource, while the mitigation strategy is designed to avoid or reduce such adverse impacts.

Definitions

In order to assess, distil and present the findings of this assessment, the following definitions apply. 'Cultural Heritage' where used generically, is an over-arching term applied to describe any combination of archaeological and cultural heritage features, where –

- the term '*archaeological heritage'* is applied to objects, monuments, buildings or landscapes of an (assumed) age typically older than AD 1700 (and recorded as archaeological sites within the Record of Monuments and Places);
- the term '*cultural heritage'*, where used specifically, is applied to other (often less tangible) aspects of the landscape such as historical events, folklore

memories and cultural associations. This designation can also accompany an archaeological or architectural designation.

14.2 Methodology

This study determines, as far as reasonably possible from existing records, the nature of the cultural heritage resource within the area of the proposed development using appropriate methods of study. The methodology for predicting and assessing impacts is presented in Appendix 14.3 and the mitigation strategy for cultural heritage resources is presented in Appendix 14.4.

14.2.1 Guidance and Legislation

The following legislation, standards and guidelines were consulted as part of the assessment.

- National Monuments Acts, 1930-2014;
- The Planning and Development (Strategic Infrastructure) Bill, 2006;
- Heritage Act, 1995;
- Environmental Protection Agency (EPA) 2015 Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (Draft Sept. 2015). Dublin, Government Publications Office;
- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EIAR) (EPA 2017). Dublin: Government Publications Office;
- Guidelines on the Information to be Contained in Environmental Impact Statements, (EPA, 2002);
- Advice notes on Current Practice in the Preparation of Environmental Impact Statements, (EPA, 2003);
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht and Islands;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000;
- Architectural Heritage Protection: Guidelines for Planning Authorities, (2011), (formerly) Department of Arts, Heritage and the Gaeltacht; and
- Transport Infrastructure Ireland (TII) Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, 2005.

Appendix 14.2 presents a list of the legislation protecting the archaeological resource.

14.2.2 Consultation

Following the initial research, a number of statutory and voluntary bodies were consulted to gain further insight into the cultural background of the baseline environment, receiving environment and study area, as follows:

- Department of Culture, Heritage and the Gaeltacht – the Heritage Service, National Monuments and Historic Properties Section: Record of Monuments and Places; Sites and Monuments Record; Monuments in State Care Database; Preservation Orders and Register of Historic Monuments;

- National Museum of Ireland, Irish Antiquities Division: topographical files of Ireland;
- Waterford Council: Planning Section; and
- Historical and Ordnance Survey Maps.

14.2.3 Desktop Study

The following sources were examined and a list of areas of archaeological and cultural heritage potential was compiled:

- Record of Monuments and Places for County Waterford;
- Sites and Monuments Record for County Waterford
- National Monuments in State Care Database;
- Preservation Orders;
- Register of Historic Monuments;
- Topographical files of the National Museum of Ireland;
- Cartographic and written sources relating to the Proposed Scheme;
- Documentary sources;
- Aerial photographs;
- Waterford City Development Plan 2013-2019; and
- Excavations Bulletin (1970–2017).

Record of Monuments and Places (RMP) is a list of archaeological sites known to the National Monuments Service, which are afforded legal protection under Section 12 of the 1994 National Monuments Act and are published as a record.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Service as 'un-located sites' and cannot be afforded legal protection due to lack of locational information. As a result, these are omitted from the RMP. SMR sites are also listed on a website maintained by the Department of Culture, Heritage and the Gaeltacht (DoCHG) – www.archaeology.ie.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each monument. The Minister for the DoCHG may acquire National Monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

Preservation Orders List contains information on Preservation Orders and/or Temporary Preservation Orders, which have been assigned to a site or sites. Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent and at the discretion of the Minister.

Register of Historic Monuments was established under Section 5 of the 1987 National Monuments Act which requires the Minister to establish and maintain such a record. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

Topographical files of the National Museum of Ireland is the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information on the discovery of sites of archaeological significance.

Cartographic and Written sources are important in tracing land use development within the development area as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies or structures that no longer remain within the landscape. The cartographic sources consulted during this assessment are described in Section 14.3.3 and include:

- *William Petty's Down Survey Map, Waterford Liberties, 1654-56;*
- *Map of Waterford from 1673 (reproduced in Ryland 1824);*
- *Richards and Scale's Plan of the City and Suburbs of Waterford, 1764; and*
- *Ordnance Survey 6-inch and 25inch maps of County Dublin (1837, 1871, 1907)*

Documentary sources were consulted to gain background information on the archaeological, architectural and cultural heritage landscape of the proposed development area.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeology. A number of sources were consulted including aerial photographs held by the Ordnance Survey and Google Earth.

Development Plans contain a catalogue of all the Protected Structures, Architectural Conservation Areas (ACAs) and archaeological sites within the county. The Waterford City Development Plan (2013–2019) was consulted to obtain information on cultural heritage sites in and within the immediate vicinity of the proposed project.

Excavations Bulletin is a summary publication that has been produced every year since 1970. This summarises every archaeological excavation that has taken place in Ireland during that year. Up until 2017 and since 1987 this publication has been edited by Isabel Bennett. This information is vital when examining the archaeological content of any area, which may not have been recorded under the SMR and RMP files. This information from 1970 to 2017 is also available online (www.excavations.ie).

14.2.4 Field Inspection

A field inspection is necessary to determine the extent and nature of archaeological and industrial archaeological remains and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information. The archaeological field walking inspection was carried out on 16th March 2018 and entailed:

- Inspecting the proposed development area and its immediate environs;
- Noting and recording the terrain type and land usage;
- Noting and recording the presence of features of archaeological and/or industrial archaeological significance;
- Verifying the extent and condition of any recorded sites; and
- Visually investigating any suspect landscape anomalies to determine the possibility of them being of anthropogenic origin.

14.2.5 Underwater Archaeological Assessment

The aim of the underwater archaeological impact assessment was to determine the significance of the known archaeology, identify previously unrecorded archaeology; and to recommend mitigation measures to minimise any negative impacts of the redevelopment project on potential archaeological remains. The underwater archaeological impact assessment report is presented in Appendix 14.5.

In addition to the sources listed in 14.2.3, the Shipwreck Inventory of Ireland was consulted. The information contained within the inventory was gathered from a broad range of cartographic, archaeological and documentary sources, and each entry in the Inventory gives information on the ship's name, type of vessel, port of origin, owner's name, cargo, date of loss and other relevant information where available.

A marine geophysical survey was undertaken by Hydromaster Ltd. in September 2018. The acoustic survey was conducted with a Reson Teledyne T-50 P Multibeam, ultra-high resolution Multibeam Echosounder. The magnetic survey was conducted with a Marine Magnetics SeaSPY Magnetometer, well suited for the detection and mapping of all sizes of ferrous objects.

A dive survey was also undertaken in September 2018 by a five-person team including dive supervisor, dive tender, stand-by diver and diver.

14.3 Description of Receiving Environment

14.3.1 Archaeological and Historical background

Although very recent discoveries may push back the date of human activity by a number of millennia (Dowd and Carden, 2016), the Mesolithic period (c. 7000-4000BC) is the earliest time for which there is clear evidence of prehistoric activity in Ireland. During this period people hunted, foraged and gathered food and appear to have had a mobile lifestyle. Evidence of permanent settlement during this period is rare, although Mesolithic deposits are typically found within riverine and coastal areas. The first evidence of human occupation in the Waterford area dates to the Mesolithic Period, as seen by the large quantities of Late Mesolithic implements, around 5000 BC, found during the Bally Lough project (Zvelebil *et al.*, 1996). The River Suir would have been an excellent resource for people to utilise in terms of food, water and transport during the prehistoric period.

During the Neolithic period (c. 4000–2400 BC) communities became less mobile and their economy became based on the rearing of stock and cereal cultivation. This transition was accompanied by major social change. Agriculture demanded an altering of the physical landscape. Forests were cleared and field boundaries constructed. There was a greater concern for territory, which saw the construction of large communal ritual monuments called megalithic tombs, which are characteristic of the period. A number of Neolithic tombs are located in the vicinity of Waterford City, such as the portal tomb (WA017-016) located at Ballindud, c. 3.8km to the south and a megalithic structure (WA018-004), located at Ballygunnertemple, c. 5.3km to the southeast.

The Bronze Age in Ireland was marked by the use of metal for the first time. As with the transition from Mesolithic to Neolithic, the transition into the early Bronze Age was accompanied by changes in society. Megaliths were replaced in favour of individual, subterranean cist or pit burials that were either in isolation or in small cemeteries. These burials contained inhumed or cremated remains and were often, but not always, accompanied by a pottery vessel. Settlement traces from the Bronze Age (2500–800 BC) are plentiful in the area surrounding Waterford City, ranging from wedge tombs and cist burials, containing burials accompanied by 'Food Vessel' pottery, to large numbers of standing stones to the southwest of the city. There is a standing stone close to the city at Gibbet Hill (Moore, 1999). A bronze axehead in the National Museum, Dublin, was found in 1836 in 'the suburbs of Waterford'.

The most common Bronze Age site within the archaeological record is the burnt mound or fulacht fiadh. The term fulacht or fulacht fiadh is found in early Irish literature from at least the 9th century AD and refers to open air cooking places. Over 4500 fulachta fiadh have been recorded in the country making them the most common prehistoric monument in Ireland (Waddell, 1998). Even though they may have functioned as cooking sites, dates in the mid-late Bronze Age (1500–600BC) show that they significantly predate the cooking sites referred to in early Irish literature (Brindley & Lanting, 1990). There are a number of recorded burnt mounds and fulachta fiadh located within the area surrounding Waterford city, the closest of which is KK046-013001, located c. 1.2km to the east of the proposed bridge.

The foundation of Waterford as a city dates to the Viking Age and the earliest date for the city itself is generally accepted around AD 912-33. Waterford began as a defended Viking *longphort* or ship-fortress and became Ireland's second city after Dublin. The original name, *Vedrarfjordr* is an Old Norse name likely meaning 'windy fiord'. Its great parchment book (1361–1649) represents the earliest use of the English language in Ireland for official purposes and demonstrates the importance of the city as the regionally pre-eminent port in the medieval period. The town developed from an early fort at Reginald's Tower, along the ridge of high ground which eventually became High Street and Peter Street. It was laid out in a regular, chequered street pattern. Excavations at the western limit of the early town at Bakehouse Lane indicate the earliest fortifications comprised an earthen bank, constructed from the spoil of a deep moat-like ditch topped by a wooden palisade. Later during the 12th century, just before the Anglo-Norman invasion, the bank was fortified further by a stone wall (Plate 14.2). Material dated from underneath this bank gave an approximate date of between 898 and 920 AD (Scully, unpublished).

The proposed bridge is to be located to the north west of the 'Viking Triangle' (as now defined). Originally the triangle extended between Reginald's Tower and Martin's Gate to the site of Turgesius' Tower, at the river end of Barronstrand Street (Scully, 2013a). Recently the 'Viking Triangle' has been reduced to indicate a smaller area with Colbeck Street and Bishop's Palace at the base (*ibid*.).

The Waterford City Development Plan (2013–2019) describes the 'Viking Triangle' (or the Trinity Within Architectural Conservation Area) as:

> "*set on the north-eastern edge of promontory where the Suir once met the confluence of John's Pill (now The Mall). This area would have been where the Viking longphort was founded. This would have been the lowest point of the landscape. Later Dundory Fort, which adjoined and included Reginald's Tower, was built in this area providing us with the Viking Core of the City. This section of the Trinity Within ACA is the oldest continuously-populated urban area in Ireland. Therefore, the area is of particular Historical and Archaeological significance and falls wholly within the City's Zone of Archaeological Potential. Archaeological excavations within this locality have revealed a wealth of artefacts and architectural features dating back to the Viking and Medieval periods. The name of the ACA is generated from its location in the Parish of Trinity Within*".

In 1170, the city was captured by Anglo-Norman forces led by Richard de Clare, known as 'Strongbow', and Dermot McMurrough, King of Leinster. King Henry II landed there the following year and received the submissions of the kings of Desmond and Thomond (Bradley & Halpin, 1992). Waterford was retained by the Crown as a royal city and under this royal patronage it developed into one of the most important and prosperous towns in medieval Ireland. Waterford continued to thrive and prosper and between 1224 and 1246 three murage grants were given to Waterford to increase the walled area of the city and to accommodate the growing population which had reached the height of its power by the early 14th century under the reign of King Edward I (McEneaney 2001, 23, Plate 14.2).

During the 13th and 14th centuries, Waterford and New Ross accounted for more than half of all Irish trade (*ibid.*). Trade rivalry between these two towns continued from the 13th to the 16th century. Waterford was involved in the trading of wine with Bordeaux, including acting as an entrepot, such as in 1300 when 3000 hogsheads of wine were re-exported to supply King Edward I's army in Scotland (Barry, 1995) as well as with towns such as Southampton, Chester and Bristol.

The medieval period was characterised by the foundation of a large number of ecclesiastical sites throughout Ireland in the centuries following the introduction of Christianity in the 5th century AD. These early churches tended to be constructed of wood or post-and-wattle. Between the late 8th and 10th centuries, mortared stone churches gradually replaced the earlier structures. Many of the sites, some of which were monastic foundations, were originally defined by an enclosing wall or bank. In addition to the cathedral, there were seven parish churches in Waterford city, the closest of which to the proposed development is St Peter's (WA009-005023) dating to at least 1314, located c. 290m to the south, but also including the parish church of St Olave's (WA009-005022). This is likely to have been a pre-Anglo-Norman foundation, although the earliest reference to it dates to 1407. It is located c. 315m to the southeast of the proposed bridge.

Various orders such as the Augustinians, Franciscans, Benedictines, Dominicans, and Knights Hospitallers set up monasteries and hospitals in Waterford City and its surrounds. The Dominican priory of St Saviour (WA009-005031) located c. 167m to the southeast, was established by 1230 within the Anglo-Norman defences of the Viking city. Other such religious houses include the Franciscan friary (WA009-005032), located c. 360m to the southeast and the Benedictine Priory (WA009-005030) located c. 600m to the south. The Augustinian priory of St Catherine (WA009-005029), located c. 645m to the southeast was founded before 1200 and was later claimed by King John as one of his foundations. St Bridgit's church

(WA009-005027), located c. 570m to the southeast, was granted to the Knights Templar in 1224 and later to the Knights Hospitallers in 1313.

A number of medieval houses are listed within the RMP records of Waterford City including seven located within a 250m radius of the proposed bridge (Plate 14.1 and Table 14.1). The closest is a medieval house (WA009-005051), located c. 172m southeast. By the end of the medieval period, the walled area of the town had nearly doubled in size (Barry, 1995).

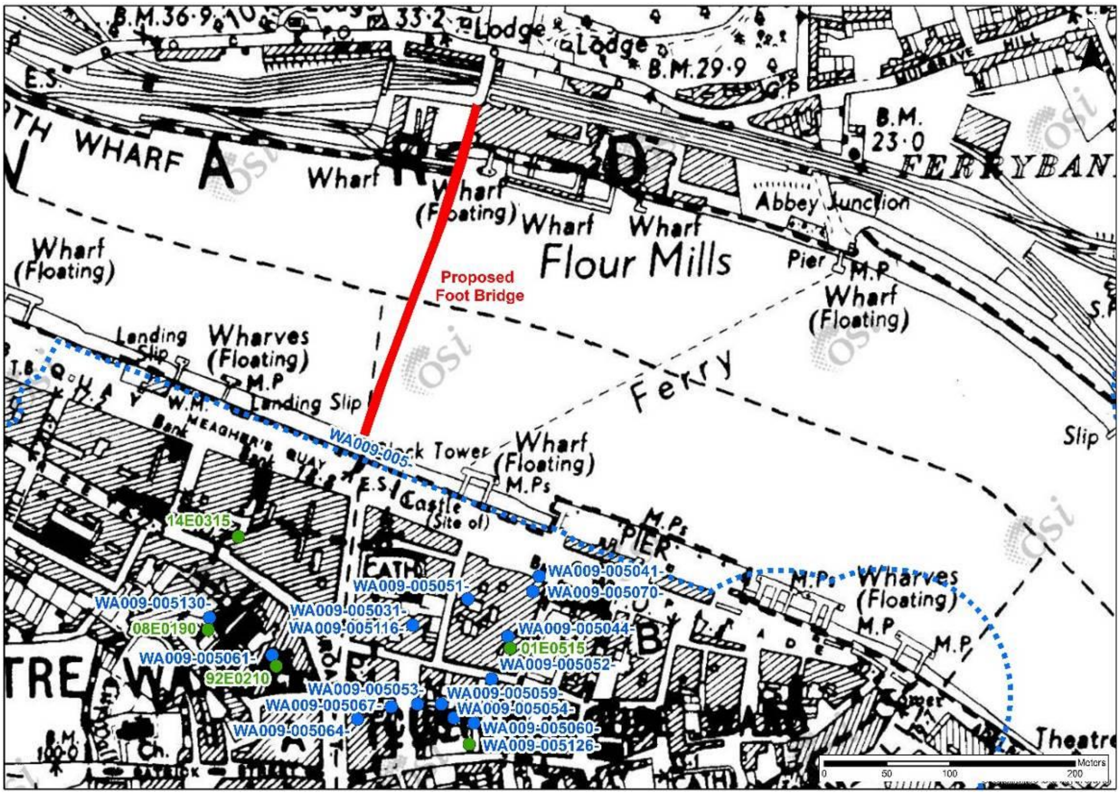

Plate 14.1 **Extract from RMP map showing the location of the proposed development (red), recorded monuments (blue) and previous archaeological investigations (green)**

Waterford remained the second city in Ireland throughout the 16th century, through a flourishing trade industry. This declined by the end of the century due to the curtailment of trade with Spain and the situation worsened during the religious and social upheavals of the 17th century. The city was later revived by a new quay construction in the early 18th century, which involved the demolition of waterfront fortifications and half-timbered houses in the area. This was undertaken during the mayoralty of David Lewis Esq.; Ryland states that *'the quay was greatly enlarged, by throwing down the town walls. He also threw down Baron-strand gate; filled the great ditch, which then joined that gate and the town wall; and made a communication between the old quay and the new. The present quay and several of the fine buildings on it, including the exchange, were commenced in his time*' (Ryland 1824, 178-9).

The city began to spread onto reclaimed ground beyond the medieval walls. Smith noted that in 1746 Waterford's Quays were over half a mile long and paved and faced with cut stone; it was over 40 feet wide in parts and was fully equipped with the infrastructure expected of a major European port (Smith 1746). The quay allowed for trade with North America as well as with England and the Continent. A bridge built across the River Suir in 1793 greatly improved communications with the hinterland to the north, which had been hitherto cut off from the bustling city to the south.

The period of economic depression which followed the Napoleonic wars led to a collapse of trade in some sectors. The city became industrialised with the development of steam power and the advent of railway, with as many as six lines into and out of the city.

14.3.2 Summary of Previous Archaeological Fieldwork

A review of the Excavations Bulletin (1970–2017) has shown that while no archaeological investigations have been undertaken on either the northern or southern sites of the proposed bridge, a number of archaeological excavations have been carried out within the surrounding area. Further to the south and southeast, multiple excavations have been carried out within the medieval core of the city.

Excavation at Little Patrick St. and Barronstrand St., c. 200m to the south of the southern site of the proposed bridge, in 1992 revealed fragmentary remains of medieval floors and plots dating from the mid-12th to the early 13th century. This was overlaid by two levels of mid-13th century ironworking and 19th-century walls and drains (Bennett, 1993: 219, Licence Ref.: 92E0210). This site has been listed in the Record of Monuments and Places as WA009-005061.

Nearby archaeological testing was undertaken at Nos 31, 32 and 33 Great Georges Street, c. 170m to the southwest of the proposed bridge (Bennett, 2014:413, Licence Ref.: 14E0315). The original Anglo-Norman town wall is upstanding to the southeast of the site, see Plate 14.2. The excavation confirmed that the projected line of the town wall crosses the street and also found the interior of No. 31 to be a backfilled brick-built cellar. No archaeological deposits were present in No. 30.

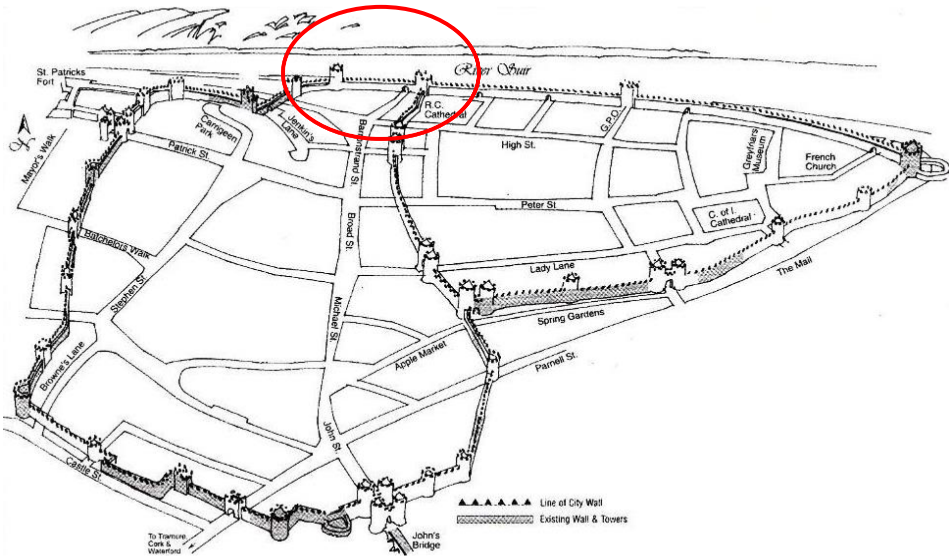

Plate 14.2 The Anglo-Norman town walls of Waterford with proposed development area circled (McEneaney 2001, 95)

Archaeological testing (08E0190) at the rear of No. 9, George's St., c. 175m to the southwest of the proposed bridge, uncovered evidence of a medieval pit (visible dims. 1.5m x 1m; D 0.6m) extending beyond the site (Bennett, 2008: 1245). This site has been listed in the Record of Monuments and Places as WA009-005130.

Archaeological testing at the junction of Exchange St. and High St., c. 225m to the southeast of the proposed bridge was undertaken in 1984 and 1985. This exposed 17th century features including a laneway, a courtyard with a well, ovens and a drainage system. This site has been entered into the Record of Monuments and Places (WA009-05044). Earlier material dating from the 12th to the 14th centuries, mainly comprising pits, trackways and hearths, was also uncovered (Bennett, 1985:55). This site was subject to further investigation in 2001 when archaeological testing was undertaken (Licence Ref.: 01E0515). This established that no archaeological remains of the ancient High Street frontage survived but an area to the north contained remains from the 12th–18th centuries (Bennett, 2001:1250).

During extensive excavations in Waterford City, a series of rubbish pits were found c. 245m southeast of the proposed bridge. Numbering a total of 496 pits, they were classified into six types-unlined (415), clay-lined (5), wattle-lined (24), timber-lined (14), stone-lined (37), and a single pit lined with oak chips. Timber-lined pits dated to the late 11th/early 12th century, while the stone-lined pits likely dated to the 13th century. Also found were 20 ovens, often simple flat stones embedded in clay and surrounded by low walls with extensive oxidisation of the clay, mainly dating from the 13th to the 15th centuries. Ten kilns were also recorded, the majority of which were keyhole-shaped and dated to the 13th and 14th century. The majority were used for drying corn, but lime production and two post medieval clay-pipe kilns were also recorded. These sites were entered into the Record of Monuments and Places as WA009-005060 and WA009-005126 respectively.

14.3.3 Cartographic Analysis

William Petty's Down Survey Map, Waterford Liberties, 1654-56

This map does not show the area of proposed development in great detail, see Plate 14.3. Waterford city is shown as a well-developed town with a clear street lay out and numerous ecclesiastical structures. St Catherine's Abbey, located c. 665m to the southeast, is marked clearly and named on this map. The estuarine defences are marked as Watergate. The proposed development is located to the east of this structure. The surrounding landscape is mapped by parish. The city does not extend to the northern bank of the River Suir in this map. Everything north of the river is considered as part of County Kilkenny. The northern site of the proposed bridge is located in Kilcleheene. The gibbet (KK046-007), located c. 600m to the northwest of the proposed bridge, is marked and annotated on this map.

Plate 14.3 Extract from the Down Survey Map (1654-6) showing the approximate location of the proposed development area

Map of Waterford from 1673 (Reproduced by John Murray 1821)

This map of Waterford shows the city walls running along the south bank of the river, where the proposed development is due to be located, as presented in Plate 14.4. A narrow quay is depicted beyond these walls with a series of piers and slips extending into the river. Barronstrand Street is referred to as "Barry's Strand", at the northern end of which stood a mural gate referred to as "Barry's Strand Gate". To the immediate west of the approximate location of the proposed development is a mill building with a single waterwheel, fed by a mill race. To the east of the proposed development area is a slip or stream.

Richards and Scale's Plan of the City and Suburbs of Waterford, 1764

Significant development works were carried out along the quays during the early 18th century, greatly increasing its length and capacity to berth ships, as presented in Plate 14.5. This map depicts the area around the proposed development, including these developments, in reasonably good detail. As per the historical record, it can be seen that the city wall has been demolished from Barronstrand Street eastwards. The quay has been expanded in a westerly direction. At the approximate site of the proposed southern bridge landing, a structure called a "Fishhouse" was constructed. The northern bank of the river is undeveloped at this stage.

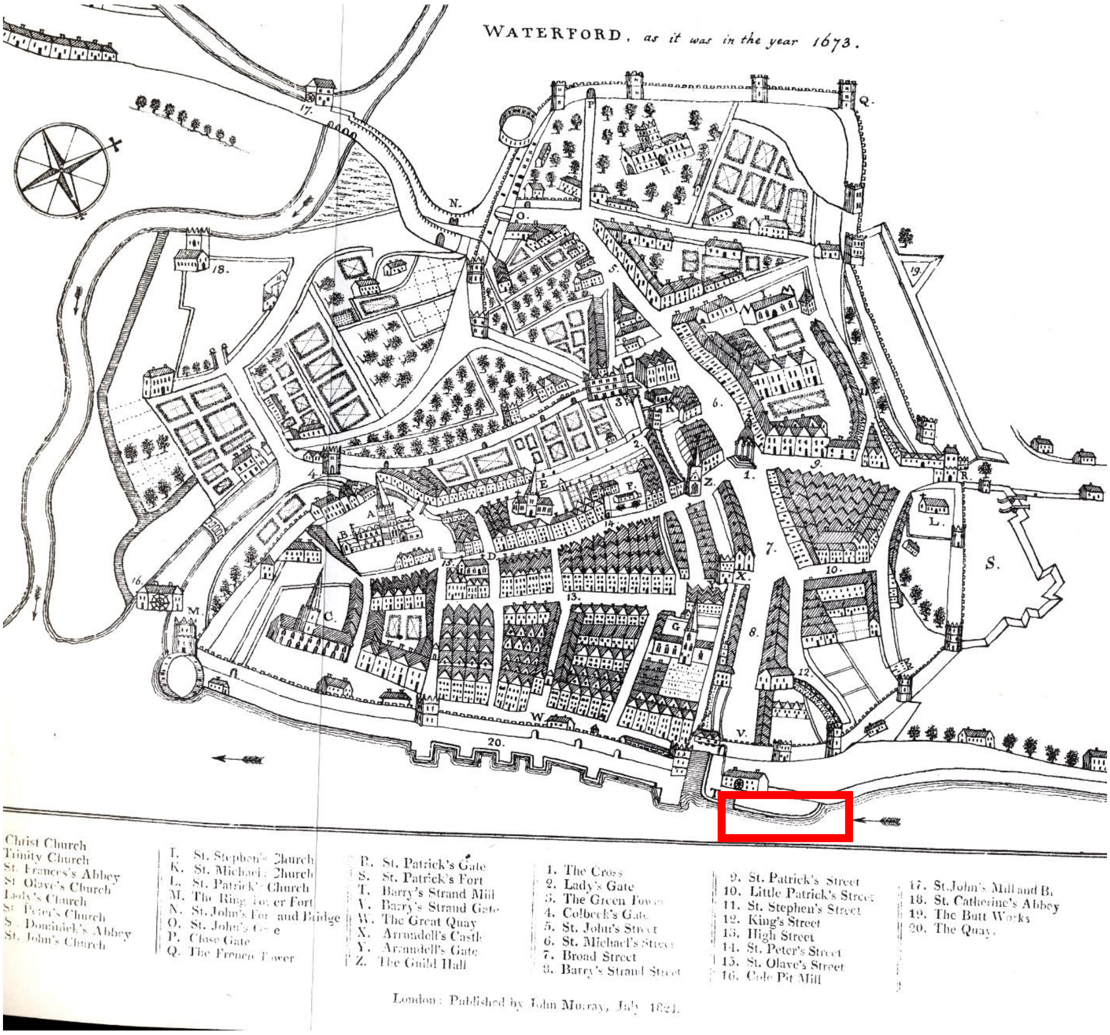

Plate 14.4 **Extract from 1673 Map of Waterford (reproduced in 1823)**

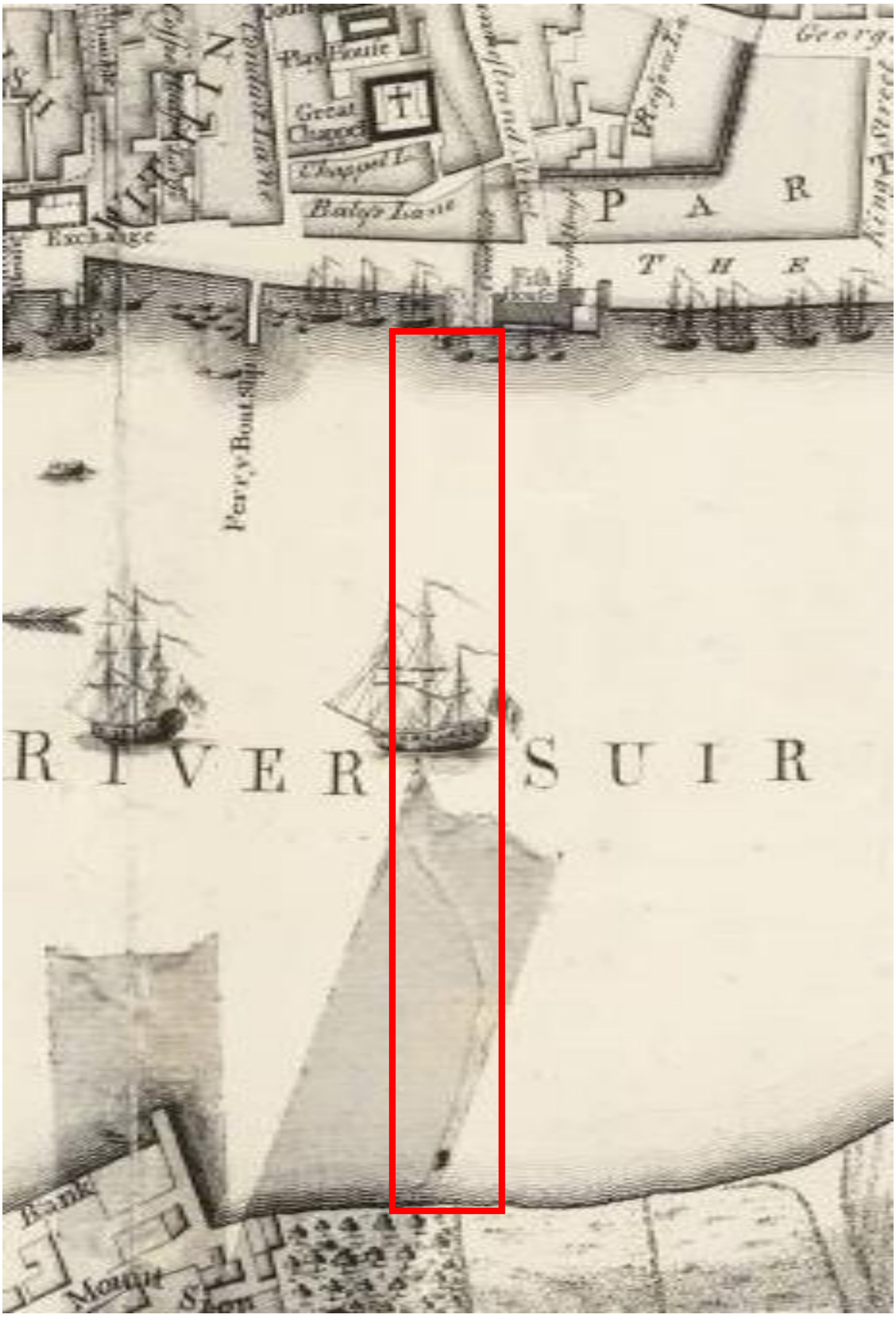

Plate 14.5 **Extract from Richard's and Scale map (1764), showing the approximate location of the proposed development area**

First Edition Ordnance Survey Map, 1839-41, *scale 1:10,560*

The first edition Ordnance Survey map is the first available cartographic source to show the area of the proposed development in great detail, as presented in Plate 14.6. It is the first instance where "Coal Quay" and "Meaghar's Quay" are labelled.

The Fishhouse is no longer depicted. Tidal silt build-ups are shown on both the north and south bank. The northern site of the proposed bridge is located in the townland of Ferrybank with dockland stores to the west and a flour mill to the east. The demesne estate Sion Lodge is located to the immediate north. The northern bank of the River Suir has a narrow belt of dockland and industry separating the river from the extensive demesne estates to the north.

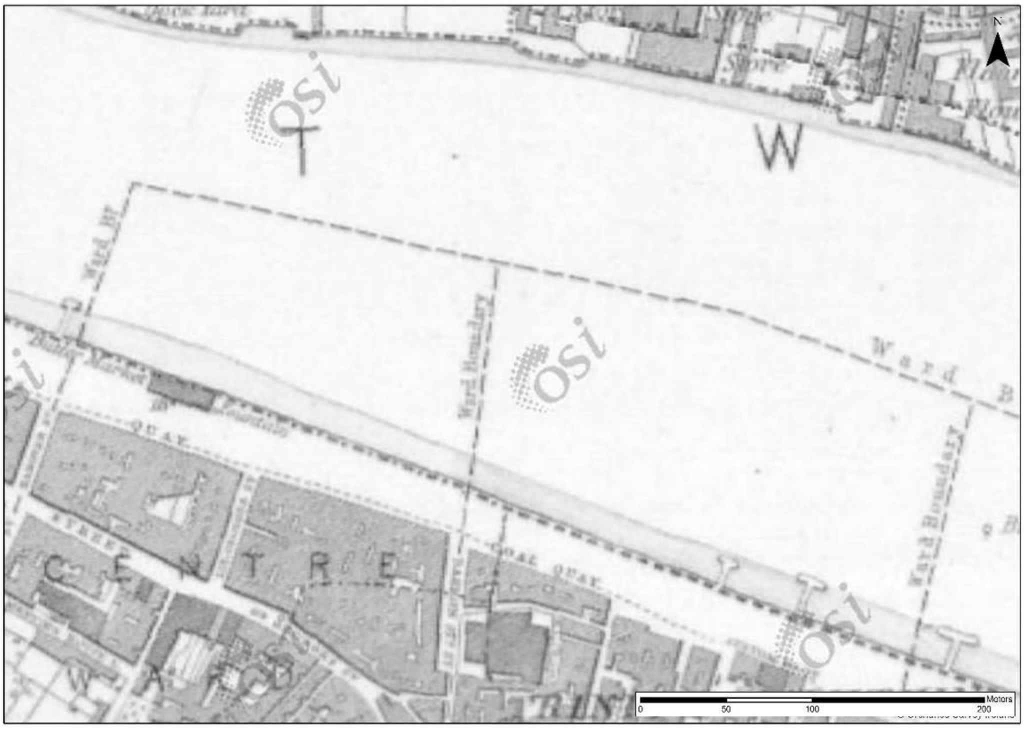

Plate 14.6 **Extract from the first edition Ordnance Survey map (1837), showing the landscape containing the proposed development**

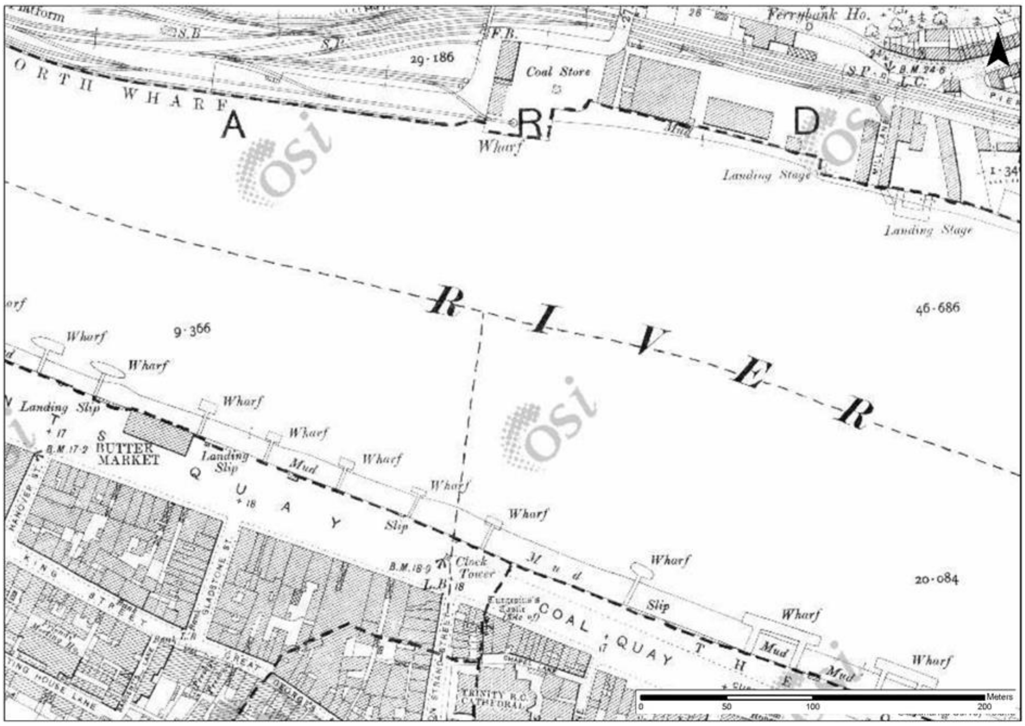

Plate 14.7 **Extract from the 24-Inch edition Ordnance Survey map (1908), showing the landscape containing the proposed development**

Ordnance Survey Map, 1897-05, scale 1:1,056

The greatest change in this later map is that the Fishguard and Rosslare Railway adjacent to the northern site of the proposed bridge has been constructed by this point, see Plate 14.7. There are no other significant changes to note within the vicinity of the proposed bridge.

14.3.4 City Development Plan

The Waterford City Development Plan (2013–2019) recognises the statutory protection afforded to all RMP sites under the National Monuments Legislation (1930–2014).

> "*Waterford City contains 111 Recorded Monuments protected under the National Monuments Act 1930-2004. A significant number of archaeological sites and monuments have been added to the Record of Monuments and Places as a result of excavations in the City in recent years. The development of three museums in the Viking Triangle area of the City in 2011 testifies to the importance of Waterford's cultural heritage*".

The development plan lists a number of aims and objectives in relation to archaeological heritage, as presented in Appendix 14.2. It is a policy of the Waterford City Development Plan to promote the in-situ preservation of archaeology as the preferred option where development would have an impact on buried artefacts. Where preservation in-situ is not feasible, sites of archaeological interest shall be subject to archaeological investigations and recording in line with best practice, in advance of redevelopment. A total of 17 RMPs sites are located within a c. 250m radius of the proposed bridge location, all south of the River Suir, as presented in Table 14.1, Figure 14.1 of Volume 3 and Plate 14.1. The RMPs are also presented in Appendix 14.1. This includes the zone of the archaeological potential for the town (WA009-005), in which the southern side of the proposed bridge is located. Twelve of these sites are scheduled for inclusion in the next revision of the Record of Monuments and Places (RMP).

Table 14.1 Recorded Archaeological Sites (RMPs) within 250m of the Proposed Sustainable Transport Bridge

RMP No.	Classification	Location	Distance to Southern Site of Proposed Bridge
WA009-005	Historic town	Waterford City	Site is partially within zone
WA009-005116	Tomb - effigial	Waterford City	c. 165m southeast
WA009-005031	Religious house - Dominican friars	Waterford City	c. 170m southeast
WA009-005051	House - medieval	Waterford City	c. 170m southeast
WA009-005041	House - 16th century	Waterford City	c. 180m southeast
WA009-005070	Building	Waterford City	c. 190m southeast
WA009-005044	Habitation site	Waterford City	c. 200m southeast
WA009-005061	Habitation site	Waterford City	c. 205m south
WA009-05130	Excavation - miscellaneous	Waterford City	c. 210m southwest
WA009-005052	House - medieval	Waterford City	c. 230m southeast
WA009-005053	House - medieval	Waterford City	c. 230m south
WA009-005064	House - medieval	Waterford City	c. 240m south

RMP No.	Classification	Location	Distance to Southern Site of Proposed Bridge
WA009-005067	House - medieval	Waterford City	c. 230m south
WA009-005059	House - medieval	Waterford City	c. 240m south
WA009-005060	Excavation - miscellaneous	Waterford City	c. 245m southeast
WA009-005054	House - medieval	Waterford City	c. 250m southeast
WA009-005126	Kiln	Waterford City	c. 250m southeast

There are three National Monuments within Waterford City, one of which is in State Ownership. They are listed in Table 14.2.

Table 14.2 National Monuments within Waterford City within 250m of the Proposed Sustainable Transport Bridge

Name	National Monument No.	RMP No.	Legal Status	Description	Distance to Southern Site of Proposed Bridge
Town Defences	671	WA009-005002	Guardianship	**Town Defences**	**c. 37m southwest**

There are no monuments that possess Preservation Orders within 250m of the proposed development.

14.3.5 Aerial Photographic Analysis

Inspection of the aerial photographic coverage of the proposed development area held by the Ordnance Survey (1995, 2000 and 2005) and Google Earth (2008-2016) failed to identify any previously unknown features or areas of archaeological potential due to the urban nature of the landscape.

14.3.6 Stray Finds

The topographic archives held at the National Museum of Ireland contain lists of artefacts held at the museum or previously seen at the museum and returned to owner. There are no stray artefacts recorded in the immediate vicinity of the proposed bridge.

14.3.7 Shipwreck Inventory

While numerous shipwrecks are listed for the coastal water surrounding the Port of Waterford, none are listed for the specific area under assessment.

14.3.8 Underwater Assessment

An Underwater Archaeological Impact Assessment (UAIA) was carried out by ADCO in April 2017 under licences 17D0025 and 17R0044. This assessment focused on the six riverbed impact locations associated with the proposed River Suir Sustainable Transport Bridge (Piers A-F).

The archaeological work comprised systematic and comprehensive assessment of the riverbed surrounding the impact locations. The assessment recorded riverbed topography, provided a detailed account of the existing riverside environment, and described any riverine features encountered.

The UAIA confirmed that sections of historic quay (Features F01-F02) and associated timber wharfing depicted on the OS 25-inch map remain *in situ* beneath the concrete quay that currently delineates the north side of the river channel at that location. In addition, the potential for riverbed deposits to retain material of archaeological significance is highlighted by the presence of wreck-related material (Feature F03), comprising two planking timbers and part of a rigging-block from a sailing vessel. This wreckage was encountered at a point 5.5m southwest of the proposed location of Pier E, lying outside the impact location associated with the proposed development as shown in Plate 14.8. There is no indication that further wreckage is present, with these components most likely having been washed down from a location further upstream.

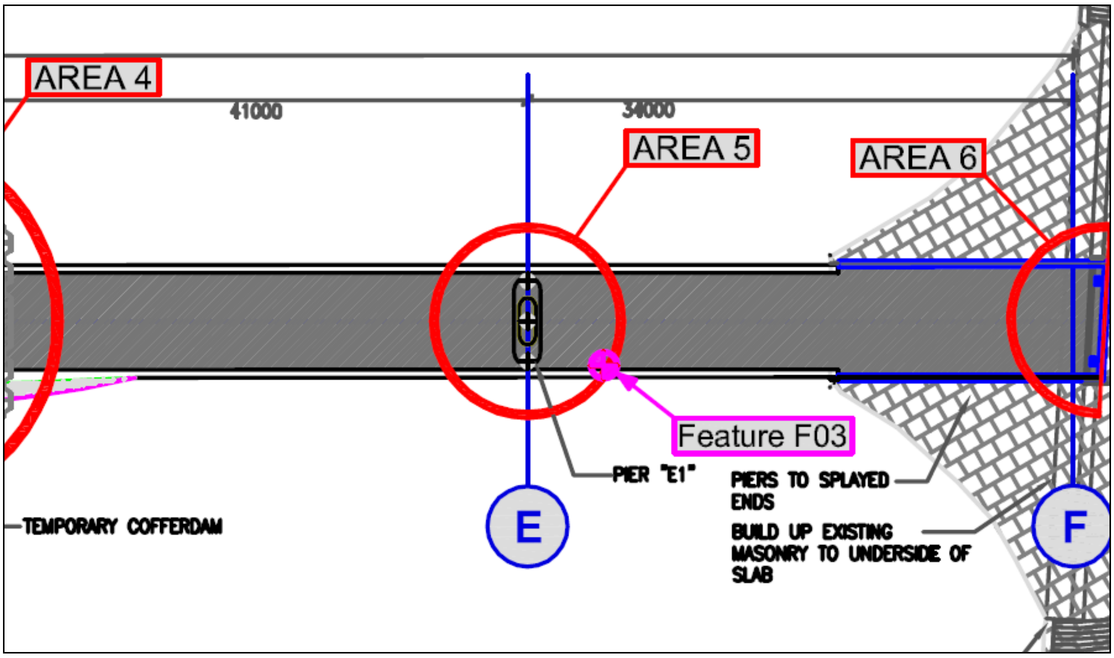

Plate 14.8 Location of Feature F03

Due to the slight change of pier locations since the ADCO survey in 2017, F03 is now located further from the Pier E location and therefore is less likely to be impacted. Plate 14.9 illustrates Area 5 in yellow as surveyed by ADCO in relation to the new pier E location.

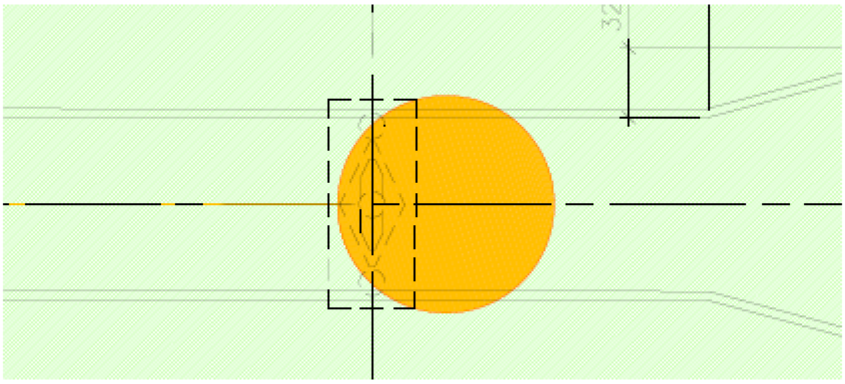

Plate 14.9 ADCO Area 5 location in relation to final pier location

No further archaeologically or historically significant material, structures, or deposits were identified as part of the assessment at the six pier impact locations.

The report recommended no additional requirements for construction-phase archaeological mitigation as part of the insertion of Piers A, B, E, and F. However, as the riverbed surrounding Piers D and E will be coffer-dammed and dewatered as part of the construction process, it is recommended that additional archaeological inspection of the river bed, within the footprint of the cofferdam, is undertaken. In addition, archaeological monitoring of any construction works in the vicinity of Features F01-F02 is recommended, allowing for the appropriate recording of these features should any unforeseen or secondary impacts occur during the construction process.

A further underwater impact assessment was carried out in September and October 2018 by Mizen Archaeology. This involved geophysical and dive surveys of the river crossing and proposed North Quay development.

The geophysical survey revealed a number of acoustic and magnetic targets; however, none were located within the footprint of the proposed bridge piers locations or north quay development. Eleven targets were identified within 20m of the proposed bridge piers and following consultation with the Underwater Archaeology Unit of the National Monuments Service, a dive survey was undertaken to investigate a sample of these targets. None of the surveyed features were of archaeological significance.

A dive survey was also carried out along the north quay development which identified a 540m section of concrete quay in a state of disrepair. Behind this are the remains of an older stone-built quay wall extending for c.480m from the bridge. The stone quay measures between 2.1m and 2.8m in height above the adjacent riverbed. It is constructed coursed squared limestone blocks. It contains multiple culverts and iron mooring rings. Some of the original timber fenders survive albeit in a very poor state of preservation. Multiple repairs and rebuilding phases are visible on the quay wall.

Immediately east of the H & R Quay is a very silted up area of the riverbank. This mudflat is exposed at low water. The fragmented remains of a timber landing stage survive here. The structure is not shown on the 1st edition Ordnance Survey map of 1871 but is illustrated on the 2nd edition map of 1907. In addition to the erect wooden piles, several loose timbers which may have formed part of the landing stage or may have floated downstream from another structure were noted beside the structure as well as branches of trees and other debris.

The report recommends that all excavation works should be archaeologically monitored by experienced, licensed underwater archaeologists with a proven track record in equivalent, similar type work. Photogrammetry of the stone quay at the North Quay landing point of the proposed development should also be undertaken in advance of the commencement of construction works.

14.3.9 Field Inspection

The area of proposed development was inspected during March 2018. Modern quayside structures are present at both the northern and southern extents of the proposed development (Plates 14.10-12). The northern extent comprises of a 20th century concrete quay, supported upon a series of hexagonal steel piles. During this site visit, access restrictions did not allow for inspection of the two sections of late 19th/early 20th century quay wall identified during the underwater archaeological assessment. To the south, the quay consists of a very modern poured concrete structure.

There was no evidence for previously unrecorded archaeological remains within the proposed development area.

Plate 14.10 Proposed location of northern landing stage of sustainable transport bridge, taken from north looking south

Plate 14.11 Location of the proposed bridge, taken from the south looking north

Plate 14.12 Proposed location of southern landing stage of proposed bridge, taken from west looking east

14.4 Predicted Impacts

14.4.1 Impact Assessment Methodology

The following impact definitions have been used in this impact assessment as defined by the Revised Guidelines on the Information to be Contained in Environmental Impact Statements, (EPA 2017), Section 3.7.7 Definition of Impacts, Page 42.

- Imperceptible: An effect capable of measurement but without noticeable consequences.
- Not significant: An effect which causes noticeable changes in the character of the environment but without noticeable consequences
- Slight Effects: An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
- Moderate Effects: An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends.
- Significant Effects: An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
- Very Significant: An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.
- Profound Effects: An effect which obliterates sensitive characteristics.

14.4.2 Potential Impacts

No direct or indirect impacts to any recorded features of terrestrial or underwater archaeological or historic significance are anticipated as part of the proposed development. However, groundworks may have a direct negative impact on any previously unrecorded archaeological features, deposits or artefacts which have the potential to survive beneath the modern quay structures or in the estuarine silts of the riverbed. This would be caused by excavation and removal of materials to facilitate the construction of bridge piers/landings etc.

14.5 Mitigation & Monitoring

It is recommended that removal of any quayside masonry or furniture should be carried out under archaeological monitoring to facilitate further recording. It may be deemed appropriate to retain and reuse any elements of particular cultural heritage significance as part of the development and these can be identified during archaeological monitoring.

The riverbed surrounding Piers D and E will be enclosed within cofferdams as part of the construction process. The cofferdams are to be dewatered as part of that process; it is recommended that an additional archaeological inspection of the riverbed within the footprint of the cofferdam is undertaken.

Photogrammetry of the stone quay at the North Quay landing point of the proposed development should also be undertaken in advance of the commencement of construction works. The photogrammetry survey should be annotated and a record should be made of the section of quay wall being removed.

All excavation works should be archaeologically monitored by experienced, licensed underwater archaeologists with a proven track record in equivalent, similar type work. Should archaeological material, wreckage, timbers or other artefacts be recorded in the course of the monitoring, the archaeologist will be empowered to recover and record the material. This may involve the temporary suspension of the work to recover the material. In the event that excavation works impact on an archaeological site, the standby archaeological dive team, in place for such eventualities, should be mobilised to undertake a dive inspection of the impacted site which may lead to further investigations and / or potentially full excavation.

Please note that all recommendations are subject to approval by the National Monuments Service of the Heritage and Planning Division, Department of Culture, Heritage and the Gaeltacht.

14.6 Residual Impacts

Should the above mitigation be undertaken, there are no predicted residual impacts on the archaeological and cultural heritage resource by the proposed development.

14.7 References

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Cartographic Sources

William Petty's Down Survey Map, Waterford Liberties 1654-56

Map of Waterford from 1673

Richards and Scale's *Plan of the City and Suburbs of Waterford*, 1764

Ordnance Survey Mapping 1839-41 and 1897-05

Electronic Sources

www.archaeology.ie – DoAHRRGA website listing all SMR sites with aerial photographs

www.bingmaps.com – Aerial photographs of the proposed development area

www.excavations.ie – Summary of archaeological excavation from 1970–2014

www.googleearth.com – Aerial photographs of the proposed development area

www.osiemaps.ie – Ordnance Survey aerial photographs dating to 1995, 2000 & 2005 and 6-inch/25-inch OS maps.

Appendix 14.1
RMP/SMR Sites located within 250m of the proposed development

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

RMP/SMR Sites Located Within 250m of the Proposed Development

SMR NO.	WA009-050
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Multiple
BARONY	Waterford City
I.T.M.	N/A
CLASSIFICATION	Historic town
DIST. FROM DEVELOPMENT	Southern site of Sustainable Transport Bridge is within zone of historic town
DESCRIPTION	N/A
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05031
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660694/ 612517
CLASSIFICATION	Religious house - Dominican friars
DIST. FROM DEVELOPMENT	c. 170m southeast
DESCRIPTION	The Dominican priory of St Saviour was established by 1230 within the Anglo-Norman defences of the Viking city (WA009-005004). Little is known of its history until its dissolution in 1541, when it consisted of a nave and chancel, a belfry and chapel, and associated buildings including a dormitory, chapterhouse, library, kitchen, storehouse, three halls and various other chambers, as well as a cemetery and gardens (Archdall, 1786). It was leased to James White after 1541 and was granted to Sir Anthony St Leger in 1599. In the 17th and 18th centuries the priory functioned as a courthouse. The remains consist of a nave and chancel with a crossing-tower and south aisle. The north nave wall has five lancet windows and the south wall has three pointed arches, now blocked, leading to the south aisle. The pointed west window is built into a larger embrasure over an inserted 18th-century doorway. The chancel is featureless and its east and south walls do not survive. The crossing-tower, now inaccessible, has four storeys and survives almost complete, except the parapet. Originally access to the tower was by mural stairs which rose through the north and east walls to the first floor which has access to the lofts over the nave and chancel — the second and third floors were reached by wooden ladders. The third floor, or belfry stage, has a twin-light, ogee-headed opening in each wall. There are mason's marks of simple parallel incisions on the chamfers of the tower piers to the west, and fragments of an effigy (WA009-005116) have been recorded from the site (Lumley, 1977), but cannot now be traced (Bradley *et al*. 1989).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05041
RMP STATUS	Yes

TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660795/ 612556
CLASSIFICATION	House - 16th century
DIST. FROM DEVELOPMENT	c. 180m southeast
DESCRIPTION	Late 16th-century building of three bays and three storeys, with two original fireplaces and a laver. Discovered during the refurbishment of a building on Exchange St. in 1992 and recorded by B. Murtagh in 1993.
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05044
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660770/ 612508
CLASSIFICATION	Habitation site
DIST. FROM DEVELOPMENT	c. 200m southeast
DESCRIPTION	Excavation by S. Stevens at Exchange St./ High St. in 1984-5 exposed 17th-century features including a laneway, a courtyard with a well, ovens and a drainage system. Earlier material dating from the 12th to the 14th centuries, mainly comprising pits, trackways and hearths, also uncovered (Stevens 1985a, 1985b; Youngs *et al*. 1985).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05051
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660738/ 612538
CLASSIFICATION	House - medieval
DIST. FROM DEVELOPMENT	c. 170m southeast
DESCRIPTION	Located off Conduit Lane on the eastern side. This is a barrel-vaulted chamber (dims. 12m x 4.25m; H 2.5m) entered through an opening in the northern wall with a window opening in the eastern wall (Bradley *et al*., 1989).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05052
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Trinity Within

BARONY	Waterford City
I.T.M.	660757/ 612474
CLASSIFICATION	House - medieval
DIST. FROM DEVELOPMENT	c. 230m southeast
DESCRIPTION	The front of the plots on the south side of High St. had been destroyed by 18th- and 19th-century basements in a strip 10m deep along the street front, but excavation sections taken from beneath High St. suggest that there were fourteen plots with houses of Dublin Type 1 fronting on to the street. The rear of these plots had been disturbed by post-medieval pits and an attempt to level the ground surface, but the remains of structures were recovered at the back of eight plots. The material dated generally from the late 11th/early 12th century to the late 12th/early 13th century and consisted of four Dublin Type 2 buildings, two houses of sill-beam construction, one sunken house close to similar houses on Olaf St., and one timber house of which only a fragment of the east wall survived with large uprights and vertical staves (McCutcheon, 1997).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05053
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660698/ 612454
CLASSIFICATION	House - medieval
DIST. FROM DEVELOPMENT	c. 230m south
DESCRIPTION	The area around Arundel Square which connects the W end of Peter St. and High St. was excavated to levels corresponding with the destruction of the Viking bank WA009-005006- in the early 12th century. At least two plots existed between the north-facing plots on High St. (WA009-005052) and the south facing plots on Peter St. (WA009-005045). From the late 12th to the early14th century two sill-beam houses, a timber house and a stone-footed house occupied these plots (McCutcheon, 1997a).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05054
RMP STATUS	No
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660727/ 612443
CLASSIFICATION	House - medieval
DIST. FROM DEVELOPMENT	c. 250m southeast
DESCRIPTION	Between Peter St. and High St. a group of six medieval plots which were isolated from street frontages (called 'Insula North' in Hurley et al., 1997) were found with evidence for houses at Levels 4 and 5 dating from the 11th to the late 12th century. Six sill-beam houses and one stone and timber house were also excavated. The latter was constructed around a mortared stone wall, with an

	outer timber framework on the long walls which is an original feature. Five north to south orientated joists supported a wooden floor which survived almost complete, and oak timbers provided dendrochronological dates ranging from the late 11th to the mid-12th century (McCutcheon and Hurley, 1997).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05059
RMP STATUS	No
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660717/ 612454
CLASSIFICATION	House - medieval
DIST. FROM DEVELOPMENT	c. 240m south
DESCRIPTION	Stone-walled houses seem to have become standard in Waterford from the mid-14th century, and the remains of ten late medieval and post-medieval houses were recovered by excavation of the area bounded by High St. and Peter St, Cook Lane and Arundel Square. The foundations of these late medieval/post-medieval houses were cut into the surface of the earlier stratified structures or the fill of medieval pits. The walls (Wth c. 0.8-1.2m) were very fragmentary and the full dimensions of the structures could not be recovered (Scully, 1997b).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05060
RMP STATUS	No
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660743/ 612439
CLASSIFICATION	Excavation - miscellaneous
DIST. FROM DEVELOPMENT	c. 250m to the southeast
DESCRIPTION	During the extensive excavations in Waterford city rubbish pits were found throughout the stratified levels, and the upper surface of the stratified material was cut by further pits. There were 496 pits in total, which contained most of the artefacts from the sites, and they were classified into six types—unlined (415), clay-lined (5), wattle-lined (24), timber-lined (14), stone-lined (37), and a single pit lined with oak chips was found. The unlined pits are ubiquitous but timber-lined pits only came into use during the late 11th/early 12th century. The stone-lined pits are more typical of the 13th century, although they could be cleaned-out and re-used at a later date. There was also evidence of twenty ovens mainly dating from the 13th to the 15th centuries. These appeared as areas of burning around a shallow pit, sometimes with traces of a circular stone structure. Ten kilns (WA009-005126-), used either to make lime or to dry corn, were also recorded. (Hurley and Sheehan 1997; Scully and McEneaney 1997).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05061
RMP STATUS	Yes

TOWNLAND	Waterford City
PARISH	St. Patrick's
BARONY	Waterford City
I.T.M.	660582/ 612493
CLASSIFICATION	Habitation site
DIST. FROM DEVELOPMENT	c. 205m south
DESCRIPTION	Excavation on the site of the Savoy Cinema on Little Patrick St. and Barronstrand St. during 1992 revealed the fragmentary remains of medieval floors and plots fronting onto Little Patrick St. Eleven levels of activity dating from the mid-12th to the early 13th centuries were represented. These were overlaid by two levels of ironworking activity dating to the mid-13th century and19th-century walls and drains (Bennett, 1993: 219).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05064
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	St. Patrick's
BARONY	Waterford City
I.T.M.	660650/ 612442
CLASSIFICATION	House - medieval
DIST. FROM DEVELOPMENT	c. 240m south
DESCRIPTION	At the rear of Nos. 17 and 18 Broad St., a building survey by Jo Moran (99E0004) identified earlier fabric in the standing 18th century structures, together with some timbers that might be medieval. Remains of the 12th or 13th century defensive bank and its ditch were uncovered in test trenches (Bennett, 1999:852).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05067
RMP STATUS	No
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660677/ 612452
CLASSIFICATION	House - medieval
DIST. FROM DEVELOPMENT	c. 230m south
DESCRIPTION	Excavation (98E0091) by J. Wren following an assessment by S. McCutcheon (97E0137) at 9 Arundel Square produced evidence of a sill-beam house which may be 12th century in date. Later in the 12th or early 13th century an earthen bank was built on the line of the 13th century city wall, and a section of wall was recorded which was dug into the bank. Soils accumulated inside the bank, and a stone-lined cess-pit was excavated partly through the bank. This was closed in the mid-13th to 14th century (Bennett, 1997:575, 1998:638).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05070
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660790/ 612544
CLASSIFICATION	Building
DIST. FROM DEVELOPMENT	c. 190m
DESCRIPTION	Archaeological monitoring (01E0515) at the eastern edge of a large site found walls associated with medieval pottery on the Exchange St. frontage. These could be interpreted as houses. They are in the area S of the 16th century building (WA009-005041; Bennett, 2003:1924).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05116
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660694/ 612517
CLASSIFICATION	Tomb - effigial
DIST. FROM DEVELOPMENT	c.165m southeast
DESCRIPTION	Effigial fragments. From the Dominican friary (WA009-005031). Two pieces derived from a limestone female or ecclesiastical effigy are present. Both show folds of a garment. These appear to be the pieces which Lumley (1977) suggested were part of a knight effigy (Bradley *et al*., 1989).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05126
RMP STATUS	No
TOWNLAND	Waterford City
PARISH	Trinity Within
BARONY	Waterford City
I.T.M.	660743/ 612439
CLASSIFICATION	Kiln
DIST. FROM DEVELOPMENT	c. 260m southeast
DESCRIPTION	Nine kilns found during Waterford city excavations, principally located at the corner of Bakehouse Lane and Peter St. They occupied the later levels and were frequently disturbed by modern activity and were therefore fragmentary. Most of the kilns are keyhole-shaped and 13th or 14th century in date. They were largely used for drying corn, but two post-medieval clay-pipe kilns were also recorded. In addition at least 20 ovens were recovered from the upper levels of the excavations. They are often simple flat stones embedded in clay and surrounded by low walls with extensive oxidisation of the clay (Hurley and Sheehan, 1997).

REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	WA009-05130
RMP STATUS	Yes
TOWNLAND	Waterford City
PARISH	St. Patrick's
BARONY	Waterford City
I.T.M.	660532/ 612523
CLASSIFICATION	Excavation - miscellaneous
DIST. FROM DEVELOPMENT	c. 210m southwest
DESCRIPTION	Archaeological testing (08E0190) at the rear of 9 George's St. uncovered evidence of a medieval pit extending beyond the site (Bennett, 2008:1245).
REFERENCE	www.archaeology.ie/ SMR file

Appendix 14.2
Legislation Protecting the Archaeological Resource

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Legislation Protecting the Archaeological Resource

Protection of Cultural Heritage

The cultural heritage in Ireland is safeguarded through national and international policy designed to secure the protection of the cultural heritage resource to the fullest possible extent (Department of Arts, Heritage, Gaeltacht and the Islands 1999, 35). This is undertaken in accordance with the provisions of the *European Convention on the Protection of the Archaeological Heritage* (Valletta Convention), ratified by Ireland in 1997.

The Archaeological Resource

The *National Monuments Act 1930 to 2014* and relevant provisions of the *National Cultural Institutions Act 1997* are the primary means of ensuring the satisfactory protection of archaeological remains, which includes all man-made structures of whatever form or date except buildings habitually used for ecclesiastical purposes. A National Monument is described as 'a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (National Monuments Act 1930 Section 2).

A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places, and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

Ownership and Guardianship of National Monuments

The Minister may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

Register of Historic Monuments

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. Any interference with sites recorded on the register is illegal without the permission of the Minister. Two months notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

Preservation Orders and Temporary Preservation Orders

Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

Record of Monuments and Places

Section 12(1) of the 1994 Act requires the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs) to establish and maintain a record of monuments and places where the

Minister believes that such monuments exist. The record comprises a list of monuments and relevant places and a map/s showing each monument and relevant place in respect of each county in the state. All sites recorded on the Record of Monuments and Places receive statutory protection under the National Monuments Act 1994. All recorded monuments on the proposed development site are represented on the accompanying maps.

Section 12(3) of the 1994 Act provides that 'where the owner or occupier (other than the Minister for Arts, Heritage, Gaeltacht and the Islands) of a monument or place included in the Record, or any other person, proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such a monument or place, he or she shall give notice in writing to the Minister of Arts, Heritage, Gaeltacht and the Islands to carry out work and shall not, except in the case of urgent necessity and with the consent of the Minister, commence the work until two months after the giving of notice'.

Under the National Monuments (Amendment) Act 2004, anyone who demolishes or in any way interferes with a recorded site is liable to a fine not exceeding €3,000 or imprisonment for up to 6 months. On summary conviction and on conviction of indictment, a fine not exceeding €10,000 or imprisonment for up to 5 years is the penalty. In addition, they are liable for costs for the repair of the damage caused.

In addition to this, under the *European Communities (Environmental Impact Assessment) Regulations 1989,* Environmental Impact Statements (EIS) are required for various classes and sizes of development project to assess the impact the proposed development will have on the existing environment, which includes the cultural, archaeological and built heritage resources. These document's recommendations are typically incorporated into the conditions under which the proposed development must proceed, and thus offer an additional layer of protection for monuments which have not been listed on the RMP.

The Planning and Development Act 2000

Under planning legislation, each local authority is obliged to draw up a Development Plan setting out their aims and policies with regard to the growth of the area over a five-year period. They cover a range of issues including archaeology and built heritage, setting out their policies and objectives with regard to the protection and enhancement of both. These policies can vary from county to county. The Planning and Development Act 2000 recognises that proper planning and sustainable development includes the protection of the archaeological heritage. Conditions relating to archaeology may be attached to individual planning permissions.

Waterford Development Plan (2013-2019)

<u>10.1 Archaeological Heritage</u>

Policy:

- To protect and enhance archaeological monuments and their settings including city walls, embankments and ditches, gates, bastions or ancillary fortifications, church sites and associated graveyards and other monuments. (POL 10.1.1)
- To protect and preserve the archaeological value of underwater archaeology. In considering development proposals the City Council will take account of rivers, inter-tidal and sub-tidal environments, and the potential to impact on previously unrecorded shipwreck, that may be over 100-years old and thus protected under the National Monuments (Amendment) Act 1987. (POL 10.1.2)
- To protect the archaeological heritage of the City as a source and instrument for historical and scientific study. (POL 10.1.3)

- To facilitate appropriate guidance in relation to the protection of the archaeological heritage of the City. (POL 10.1.4)
- To promote pre-planning consultations in relation to the archaeological heritage with the Planning Authority and with the National Monuments Service, Department of Arts, Heritage & the Gaeltacht. (POL 10.1.5)
- To promote best practice in archaeological excavation and endeavor to ensure the dissemination of the results of archaeological excavation in a timely and appropriate manner. (POL 10.1.6)
- To promote the use of the archaeological heritage of the City as an educational, cultural and tourism resource and to promote public access and awareness of this rich archaeological heritage. (POL 10.1.7)

Objectives:

- To secure the preservation (in-situ or by record) of all sites and features of historical and archaeological interest. (OBJ 10.1.1)
- To preserve the integrity of existing archaeological monuments in their settings including the integrity of city defences and to ensure that development in the vicinity of a site of archaeological interest does not unduly affect the character of the archaeological site or its setting by reason of its location, scale, bulk or detailing. (OBJ 10.1.2)
- In securing such preservation, and with regard to proposed development and/or works within or in the vicinity of archaeological monuments in Local Authority or State ownership or guardianship (i.e. National Monuments) to consult and to have regard to the advice and recommendations of the National Monuments Service, the Department of Arts, Heritage & the Gaeltacht, authorization/Ministerial Consent may be required to proceed under Section 14 of the National Monuments Acts. (OBJ 10.1.3)
- To seek to retain the existing street layout, including laneways, historic building lines and traditional plot widths where these derive from medieval or earlier origins. (OBJ 10.1.4)
- When considering development in the vicinity of upstanding archaeological/historical monuments, to aim to achieve a satisfactory buffer area between the development and the monument in order to ensure the preservation and enhancement of the amenity associated with the presence of upstanding monuments within the historic urban pattern. (OBJ 10.1.5)
- • In considering development in the vicinity of all upstanding monuments, including city defences, or development that may have implications for archaeological heritage, the Planning Authority will require the preparation and submission of an archaeological assessment report detailing the potential impact of the development on the archaeological heritage including upstanding, buried structures and deposits. The report will also include a visual impact assessment to ensure adequate consideration of any potential visual impact the proposed development may have on any upstanding remains. (OBJ 10.1.6)
- To promote the incorporation of or reference to significant archaeological finds in a development, where appropriate, through layout, displays, signage, plaques, information panels or use of historic place names. (OBJ 10.1.7)
- To provide guidance for developers, based on the experience of the archaeological environment in Waterford, and guidelines on development issued by the National Monuments Service, Department of Arts, Heritage & the Gaeltacht and the Department of the Environment, Community and Local Government, in order to

ensure that the degree of commitment to a development in terms of finance and programme, may be planned in relation to Waterford City Development Plan 2013 - 2019 140 the degree of uncertainty concerning the archaeology and the stages in its clarification and resolution. (OBJ 10.1.8)

- To prepare guidance notes/brochures for Developers for key sites in the City Centre in relation to the treatment of archaeology within such sites and possible mitigation measures. (OBJ 10.1.9)

<u>10.1.1 The Walled City</u>

Policy:

- To protect, preserve, conserve and restore, where appropriate, the upstanding remnants of the city walls and towers. (POL 10.1.8)
- To protect the essential character and setting of the City Walls and Towers through the control of the design, location and layout of new development in their vicinity and through the control of changes of use of lands, by the protection of adjoining streetscapes and site features where appropriate and by protecting important views to and from the walls and towers from obstruction and/or inappropriate intrusion by new buildings structures, plant and equipment, signs and other devices; and where opportunities arise to create additional views of the walls and towers. (POL 10.1.9)
- To utilise the City Walls and Towers as an ordering device within the urban form, by protecting and preserving and maintaining the upstanding elements and by delineating the line of the defensive system where opportunities arise. (POL 10.1.10)
- To utilise the City Walls and Towers as an educational and tourism resource and to facilitate the publication and dissemination of interpretative material to the general public, and to facilitate public access to the walls and towers. (POL 10.1.11)

Objectives:

- To preserve the integrity of the City Walls and Towers in their settings. (OBJ 10.1.9) Waterford City Development Plan 2013 - 2019 141
- To secure the preservation (in situ) of city walls, embankments, town gates, bastions or ancillary fortifications or portions thereof. (OBJ 10.1.10)
- When considering development in the vicinity of city defences, to aim to achieve a satisfactory buffer area between the development and the city defences in order to ensure the preservation and enhancement of the amenity associated with the presence of city defences within the historic urban pattern. (OBJ 10.1.11)
- To have regard to the preservation and enhancement of the line of the city defences when considering development proposed in their vicinity. Disturbance, removal and alteration of the line of city defences shall not be considered appropriate within the historic core of Waterford City. (OBJ 10.1.12)

Appendix 14.3
Impact Assessment and the Cultural Heritage Resource

ROD
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Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Impact Assessment and the Cultural Heritage Resource

Potential Impacts on Archaeological and Historical Remains

Impacts are defined as 'the degree of change in an environment resulting from a development' (Environmental Protection Agency 2003: 31). They are described as profound, significant or slight impacts on archaeological remains. They may be negative, positive or neutral, direct, indirect or cumulative, temporary or permanent.

Impacts can be identified from detailed information about a project, the nature of the area affected and the range of archaeological and historical resources potentially affected. Development can affect the archaeological and historical resource of a given landscape in a number of ways.

- Permanent and temporary land-take, associated structures, landscape mounding, and their construction may result in damage to or loss of archaeological remains and deposits, or physical loss to the setting of historic monuments and to the physical coherence of the landscape.
- Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping and the passage of heavy machinery; disturbance by vehicles working in unsuitable conditions; or burial of sites, limiting accessibility for future archaeological investigation.
- Hydrological changes in groundwater or surface water levels can result from construction activities such as de-watering and spoil disposal, or longer-term changes in drainage patterns. These may desiccate archaeological remains and associated deposits.
- Visual impacts on the historic landscape sometimes arise from construction traffic and facilities, built earthworks and structures, landscape mounding and planting, noise, fences and associated works. These features can impinge directly on historic monuments and historic landscape elements as well as their visual amenity value.
- Landscape measures such as tree planting can damage sub-surface archaeological features, due to topsoil stripping and through the root action of trees and shrubs as they grow.
- Ground consolidation by construction activities or the weight of permanent embankments can cause damage to buried archaeological remains, especially in colluviums or peat deposits.
- Disruption due to construction also offers in general the potential for adversely affecting archaeological remains. This can include machinery, site offices, and service trenches.

Although not widely appreciated, positive impacts can accrue from developments. These can include positive resource management policies, improved maintenance and access to archaeological monuments, and the increased level of knowledge of a site or historic landscape as a result of archaeological assessment and fieldwork.

Predicted Impacts

The severity of a given level of land-take or visual intrusion varies with the type of monument, site or landscape features and its existing environment. Severity of impact can be judged taking the following into account:

- The proportion of the feature affected and how far physical characteristics fundamental to the understanding of the feature would be lost;

- Consideration of the type, date, survival/condition, fragility/vulnerability, rarity, potential and amenity value of the feature affected;
- Assessment of the levels of noise, visual and hydrological impacts, either in general or site specific terms, as may be provided by other specialists.

Appendix 14.4
Mitigation Measures and the Cultural Heritage Resource

Mitigation Measures and the Cultural Heritage Resource

Potential Mitigation Strategies for Cultural Heritage Remains

Mitigation is defined as features of the design or other measures of the proposed development that can be adopted to avoid, prevent, reduce or offset negative effects.

The best opportunities for avoiding damage to archaeological remains or intrusion on their setting and amenity arise when the site options for the development are being considered. Damage to the archaeological resource immediately adjacent to developments may be prevented by the selection of appropriate construction methods. Reducing adverse effects can be achieved by good design, for example by screening historic buildings or upstanding archaeological monuments or by burying archaeological sites undisturbed rather than destroying them. Offsetting adverse effects is probably best illustrated by the full investigation and recording of archaeological sites that cannot be preserved *in situ*.

Definition of Mitigation Strategies

The ideal mitigation for all archaeological sites is preservation *in situ*. This is not always a practical solution, however. Therefore, a series of recommendations are offered to provide ameliorative measures where avoidance and preservation *in situ* are not possible.

Archaeological Test Trenching can be defined as 'a limited programme of intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site on land, inter-tidal zone or underwater. If such archaeological remains are present field evaluation defines their character, extent, quality and preservation, and enables an assessment of their worth in a local, regional, national or international context as appropriate' (IFA 2014a).

Full Archaeological Excavation can be defined as 'a programme of controlled, intrusive fieldwork with defined research objectives which examines, records and interprets archaeological deposits, features and structures and, as appropriate, retrieves artefacts, ecofacts and other remains within a specified area or site on land, inter-tidal zone or underwater. The records made and objects gathered during fieldwork are studied and the results of that study published in detail appropriate to the project design' (IFA 2014b).

Archaeological Monitoring can be defined as 'a formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons. This will be within a specified area or site on land, inter-tidal zone or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive (IFA 2014c).

Underwater Archaeological Assessment consists of a programme of works carried out by a specialist underwater archaeologist, which can involve wade surveys, metal detection surveys and the excavation of test pits within the sea or riverbed. These assessments are able to access and assess the potential of an underwater environment to a much higher degree than terrestrial based assessments.

Appendix 14.5
Underwater Archaeological Impact Assessment

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

MIZEN ARCHAEOLOGY

PROJECT: **River Suir Sustainable Transport Bridge Underwater Archaeological Impact Assessment**

PREPARED BY: **Julianna O'Donoghue and Jennifer McCarthy**

LICENSE NOS: **18R0180 and 18D0108**

DATE: **October 2018**

CLIENT: **Roughan and O'Donovan Consulting Engineers**

Mizen Archaeology, The Forge, Inishannon, Co. Cork

(023) 8858707 (086) 3844831 www.mizen.ie info@mizen.ie

Contents

Figures

Plates

1. Introduction

Mizen Archaeology Ltd. was engaged by *Roughan & O'Donovan Consulting Engineers* to undertake an underwater archaeological impact assessment (UAIA) of the proposed River Suir Sustainable Transport Bridge. The proposed River Suir Sustainable Transport Bridge is a 5-span, 8m wide bridge with a shared space for pedestrians, cyclists and a public transportation service. The bridge site location will be approximately in line with Barronstrand Street and in front of the existing Clock Tower. The proposed bridge is required to stimulate the coherent development of the city's various quarters, in particular integrating the substantial housing areas in Ferrybank and Bellfield and the proposed North Quays redevelopment with the city centre.

2. Scope of Works

The aim of this underwater archaeological impact assessment was to determine the significance of the known archaeology, identify previously unrecorded archaeology, if present; and to recommend mitigation measures to minimise any negative impacts of the redevelopment project on potential archaeological remains, if required.

3. Receiving Environment

3.1 Location

Waterford City is situated along the River Suir in the eastern extent of the county. The river is the boundary between Co. Waterford and the adjacent Co. Kilkenny. The underwater riverbed survey extended along the proposed SDZ from Edmund Rice Bridge to Frank Cassin Wharf and along the proposed river crossing from the South Quay beside the Clock Tower directly across to the North Quay (Fig. 3).

3.2 Soils and Geology

Due to the city's location along the River Suir much of the soil substrate consists of alluvium, a mixture of unconsolidated river deposits, generally silts, clays and sand and gravel. The Bedrock consists of Ordovician shale and sandstone of the Duncannon Group.

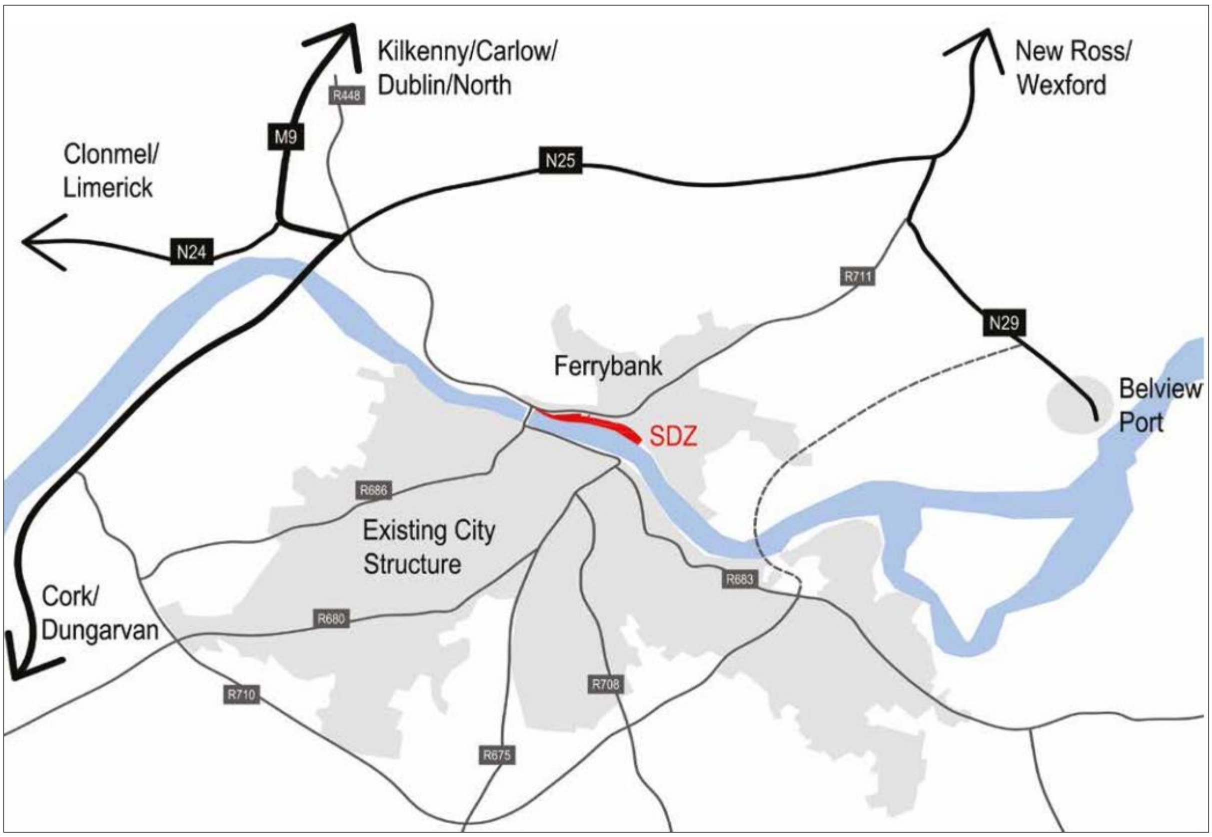

Figure 1: Site location map, taken from Waterford North Quays Strategic Development Zone Planning Scheme 2018.

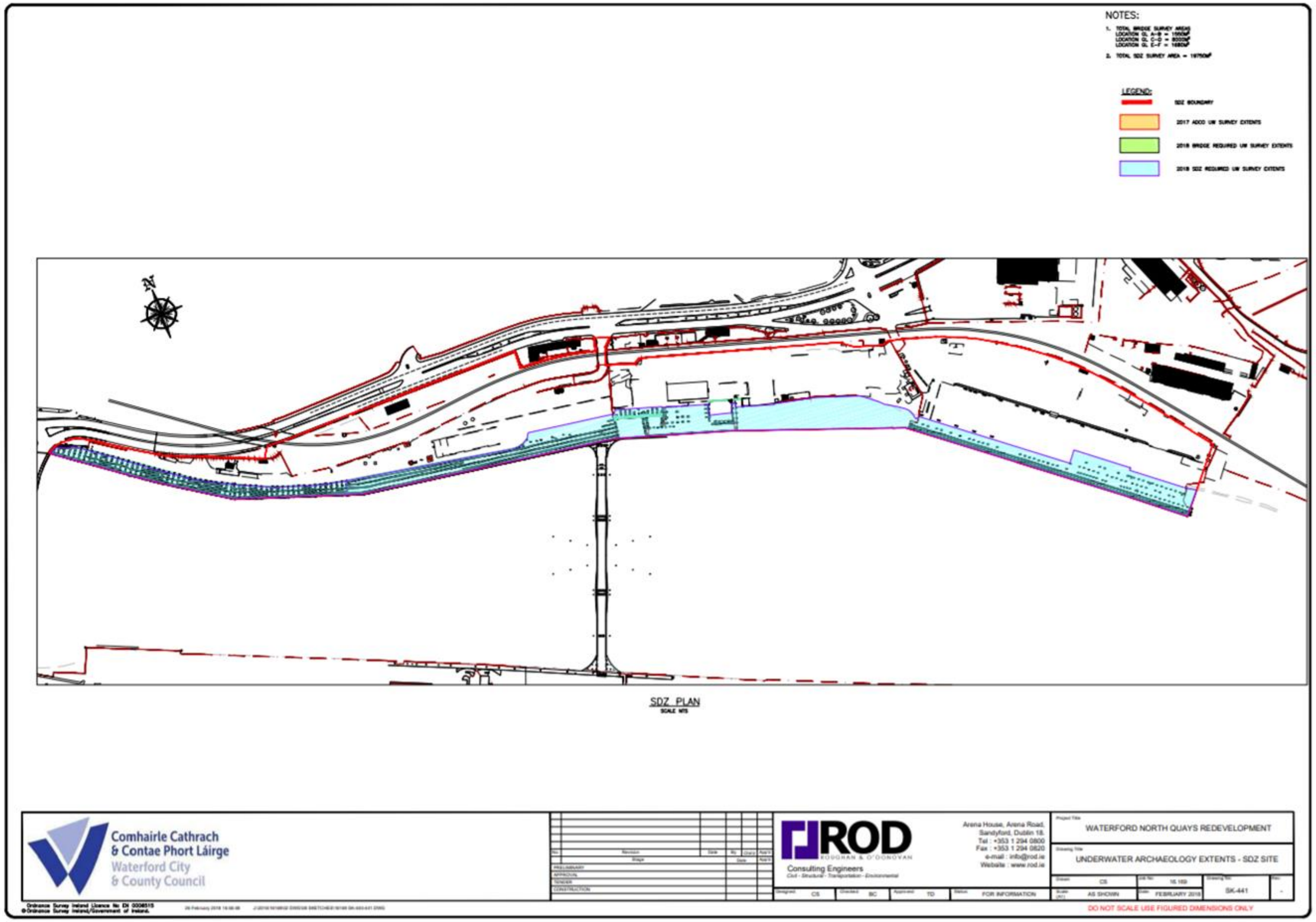

Figure 2: Site Location Map, Extent of underwater archaeological survey of North Quays (geophysics and dive survey) indicated in blue.

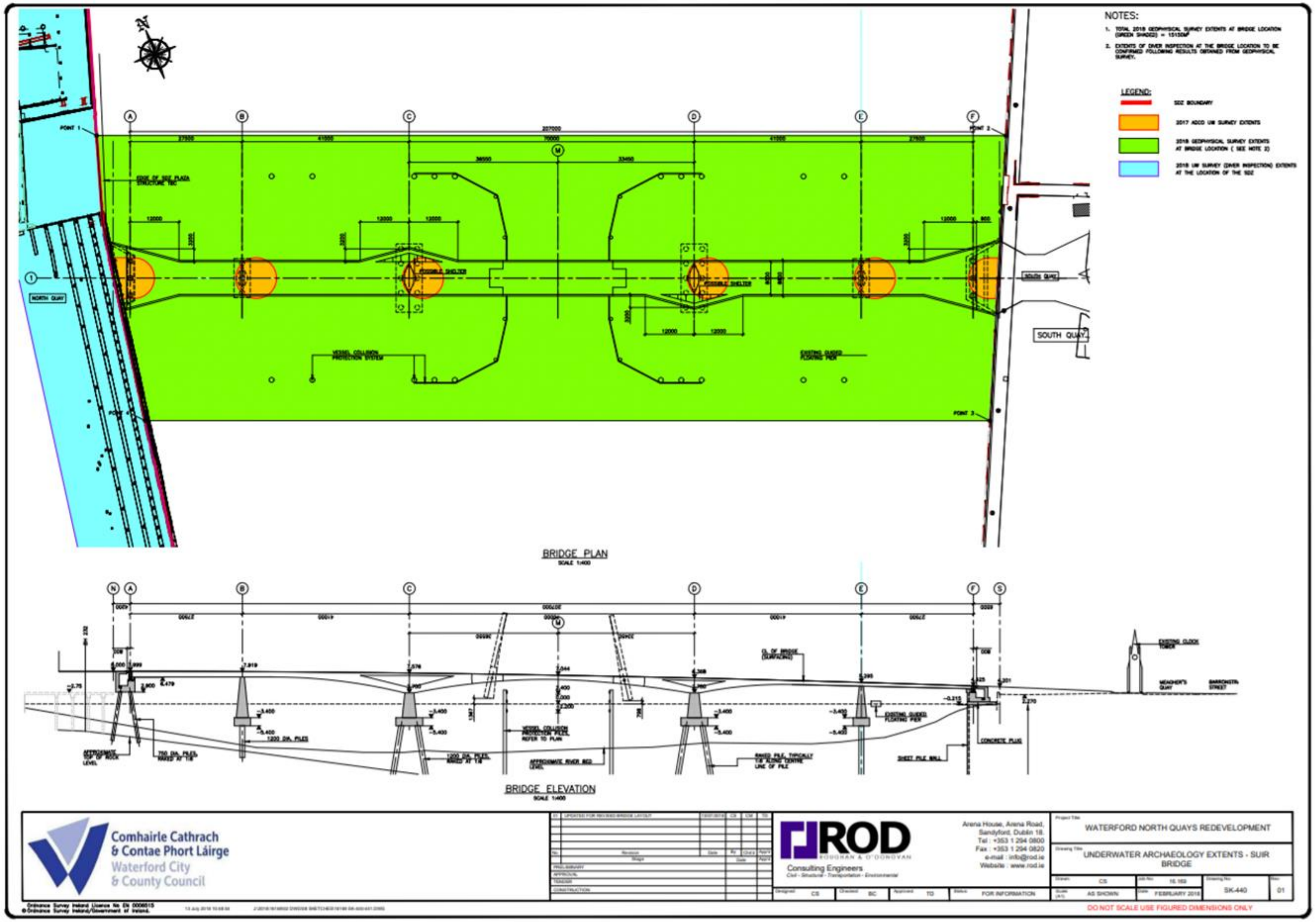

Figure 3: Site location map illustrating extend of geophysical survey (green) and previous archaeological inspection area (Orange) along proposed crossing

4. Methodology

4.1 Desktop Assessment

- The Record of Monuments and Places (RMP) was consulted. The RMP, compiled by the Archaeological Survey of Ireland, comprises lists, classifications of monuments and maps of all recorded monuments with known locations and zones of archaeological significance. The National Monuments Service Wreck Viewer was also checked. Archaeological records are also accessible online from the National Monuments Section (NMS) of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs at www.archaeology.ie. These were used to establish the wider archaeological context of the site, both marine and terrestrial.
- The Excavations Bulletin and its online database which contains summaries of all archaeological excavations (marine and terrestrial) carried out in Ireland, was also examined (www.excavations.ie).
- Cartography. Several historic maps and charts were examined (see bibliography below for a full list).
- Aerial photography: a variety of low and high-altitude aerial photography (vertical and oblique) was examined (www.archaeology.ie).
- Documentary sources: several sources were examined. For a full list of all sources examined see bibliography below.
- Shipwreck Inventory of Ireland: The information contained within the inventory was gathered from a broad range of cartographic, archaeological and documentary sources, and each entry in the Inventory gives information on the ship's name, type of vessel, port of origin, owner's name, cargo, date of loss and other relevant information where available.

4.2 Geophysical Survey

The Geophysical Survey was undertaken by *Hydromaster Ltd.* in September 2018 and complied with the unpublished guidelines for the undertaking of maritime geophysics provided by the Underwater Archaeology Unit (UAU) of the Department of Arts, Heritage and the Gaeltacht.

The acoustic survey was conducted with a Reson Teledyne T-50 P Multibeam, ultra-high resolution Multibeam Echosounder. The magnetic survey was conducted with a Marine Magnetics SeaSPY Magnetometer, well suited for the detection and mapping of all sizes of ferrous objects. The magnetometer data was corrected for diurnal variation using a fixed landward base station with synchronised clock.

4.3 Dive Survey

The dive survey was undertaken in September 2018 by a five-person team including dive supervisor, dive tender, stand-by diver and diver. A surveying engineer located the anomalies using a Trimble 5800 DGPS with <8mm accuracy.

5. Results

5.1 Historical and Archaeological Background

Waterford's location, its natural harbour and inland navigable waterways gave it distinct advantages over other ports in the country. Owing to such advantages, the city's importance is steeped in maritime history from the earliest recorded times, with evidence of the Vikings from the late 9th century and a longphort established in the early 10th century.

'Waterford' derived from one of several Scandinavian place names in the country coming from the Old Norse *Vedra(r)-fjordr*, 'ram fjord or windy fjord', while the early Irish name *Port Larige*, is thought to celebrate *Larige*, an early Viking leader (Bradley and Halpin 1992). In both instances, the important emphasis is maritime, and they indicate that the original settlement was a fortified harbour on an inlet of the sea (*ibid.* 105).

5.1.1 South Quays

Central to the development of the city were the quays, which give it its physical shape, character and history. Despite the importance of Waterford's maritime trade, there is very little information available on the early development of the quays (*ibid*). The first specific reference to the quayside does not occur until the late 14th century in which the Medieval quays of Waterford were located between Barronstrand Street and Henrietta Street on the site of Coal Quay, Custom House Quay and the Parade (*ibid*, 118). It was one of Ireland's nearest port to France and in direct line with Bristol, one of Medieval England's greatest ports (McEneaney 1992, 154). These factors made Waterford the greatest importer of wine in the country by the end of the 13th century (*ibid*). In common with the pattern known from other Irish towns the quays were privately owned (*ibid*). The reason for the construction of the quays is described by Lewis (1837):

'In 1377, in consideration of the heavy burthens and charges the citizens had sustained in the repairs of the city, and its defence against the native Irish and other enemies, Edward III. granted them the cocket customs of the port for ten years; at the same time enjoining them, as the city was exposed and

defenceless towards the sea, to take care that it be firmly surrounded and provided, and that the quays be repaired and enclosed; so that it might be protected against various enemies who were preparing to attack it on that side'.

The above indicates that the river was not walled at this time, however in 1217 the king had commanded the justiciar to give vacant space 'between the river and wall of the city of Waterford, on the river bank, to any persons who will dwell there' (Bradley and Halpin 1992, 118).

In 1541/2, the quay was expanded eastward with David Bailey being granted 'the great garden of the Friars minor of the said city and one new quay outside the walls of the city with appurtenances as far as the middle of the Suir' (Thomas 1992, 203). By the second half of the 16th century, this new quay had become an area for public trade designated for the selling of 'wood, timber and faggots' (Bradley *et al.* 1988, 171).

During the late 17th early 18th century, recovery from the post-Cromwellian decline was underway and expansion and reconstruction involved the partial demolition of the city walls, especially in the area of the quay where it had become a danger and a hindrance to trade (Sheehan 1994, 10). In 1698, Lords Justices surveyed the quay wall and declared it 'ruinous and dangerous and advised its being taken down and demolished' (Smith 1746, 170).

The council books contain numerous references to the quayside throughout the 17th century relating to repairs. In 1705, Joseph Ivie, was in the process of expanding the quay westward 'by throwing down the city walls on this side, with one of the gates, which, with the great ditch, formerly divided it into two portions' (Lewis 1837). The quay was later described by Arthur Young in 1776 as 'the finest object in this city is an English mile long, and unrivalled by any I have seen' and by the *Dublin Penny Journal* (1832) as the following:

'The Citizens of Waterford are justly proud their Quay, which is not rivalled by anything of the kind in Ireland. It is an English mile in length, and presents a continued line with scarcely any interruption throughout its entire extent, a portion adjoining the river being divided off from the carriage way the whole length of the Quay, and forming a truly delightful promenade, such as few cities can produce'.

Construction of a new quay was well advanced 40 years earlier, the Corporation stipulating that it was to be paved 40ft wide, 18ft high, 5ft wide at the foundation and to be built of good large stones and capped with hewn stones (Irish 2005, 10). The quay expanded westwards and a graving bank was included. The old medieval city wall was demolished, giving easy access to the flow of maritime commerce (*ibid*).

The mariners and merchants lived on or near the quay and imposing buildings were also associated with maritime business. Waterford merchants built a new Exchange on the quay in 1730 to serve as a centre for trading activities and other buildings on the quay included the custom house, the watch-house and the fish-house.

Quayside development continued and in 1943 Power (1943, 135) noted that, 'the only tangible relics (and these unimposing, even if significant), are a few feet of ancient wall, the frontage foundation of Sheridan's Garage, and a further short piece incorporated in the frontage of O'Grady's and Poole's premises, next to the Tower'.

5.1.2 North Quays

In the early 19th century, the north quays were largely reserved for shipbuilding activity with records of several firms present along Ferrybank. The best-known is White's shipyard, the construction of which was well advanced by 1819 (Irish 2005). White, having first developed a successful rope-walk in 1816 for shipping needs, had turned his attention to shipbuilding after he became aware of the increasing volume of shipping in the port (*ibid*).

Whites occupied an extensive area at Ferrybank having a river frontage of *c.* 210m and it is reported that up to four spacious ships could be built at any one time as well as having sufficient space for storage and other associated activity (fig 4, *ibid*, 70).

Alongside the dock yard a timber yard accommodated the materials required for shipbuilding. The end of the slipway was located c.180m from Timber-Toes Bridge. At the top of the slipway, a combination of geared wheels and pulleys allowed for the hauling out of vessels for repair (*ibid*, 29). In 1834, the business suffered a major setback when William died aged 56 after which the business passed to his two sons (*ibid*).

By 1860 all orders were for smaller vessels and the dockyard went into decline and there are no records of any ships built after 1868 (*ibid*, 41).

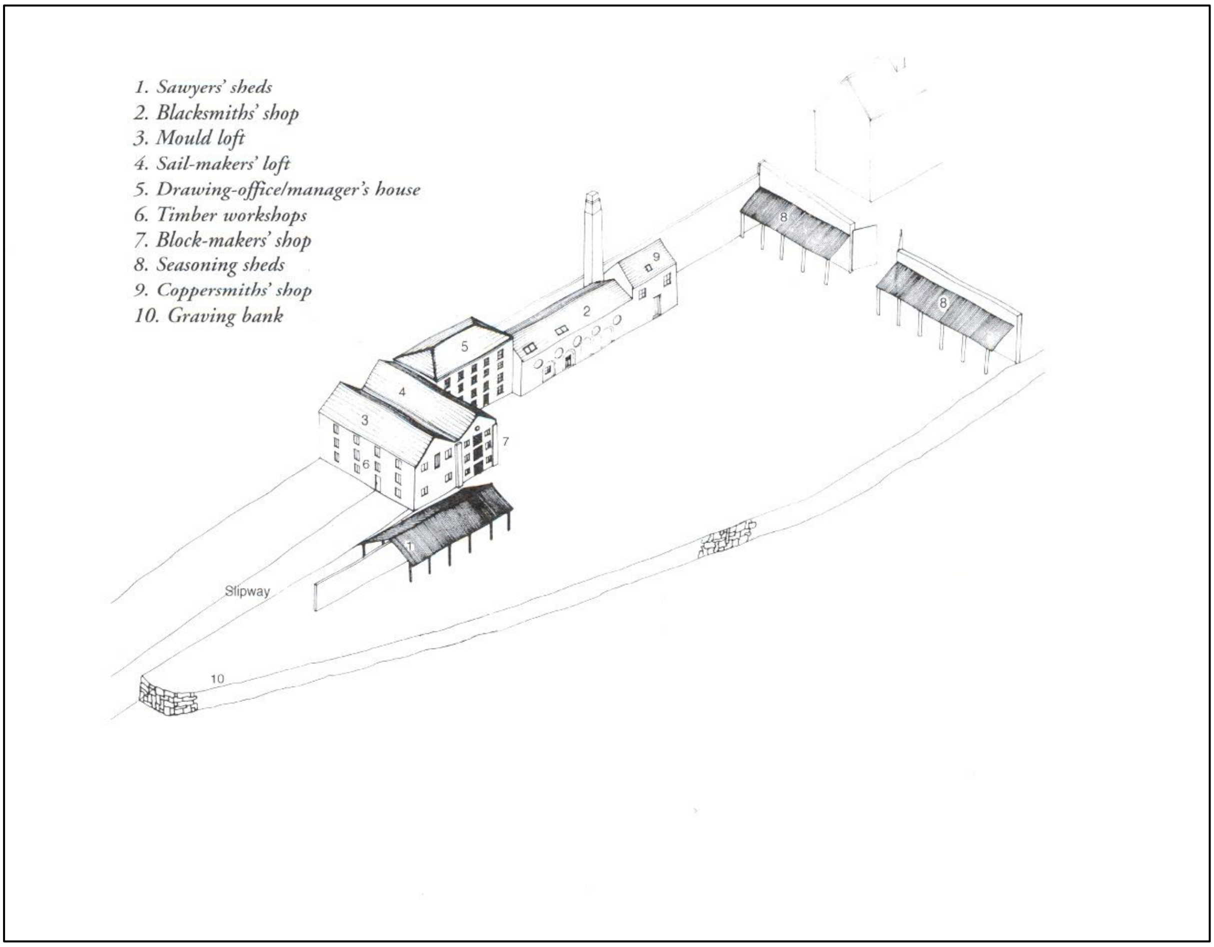

Figure 4: A reconstruction of White's shipyard and workshops (Irish 2005, 71).

Approximately 300m downstream of White's dock-yard another ship-building yard was opened by the Penrose family in 1858. By the 1770's the Penrose family were one of Waterford's wealthiest merchants, owning many ships and a large timber, coal, bacon, tanning yards (Irish 2005, 58). The scale of Penroses shipyard never came close to White's and instead concentrated on smaller projects (*ibid*, 62). The last ship recorded as being built at Penroses was in 1870 but continued activity until 1880 (*ibid*, 61).

There are several references to the establishment of shipyard by the Pope family in Ferrybank. However, research by Bill Irish indicates that, while records indicate that White's shipyard was situated in lands owned by Pope, they never built ships themselves (*ibid*, 64).

5.2 Cartographic study

There have been several early maps depicting Waterford City, including—Francis Jacobs 1591 map and the Down Survey of 1654—56, however these are lacking in accuracy and detail. The first detailed and relatively accurate map, of which production details remains unknown, is entitled 'Waterford as it was in 1673' and was published in Rylands 'History of Waterford in 1824' (Fig. 4). The map depicts the city encased behind its walls, streets and laneways and most relevant in this instance—the quay front. The map depicts a fortified south quay with a water inlet at 'Barry's Strand Gate' (Barronstrand Street) and watch towers opposite present-day Henrietta Street (Goose's Gate) and at the west end of the quay (Turgesius's Tower). Access to the quay is through four gates shown as arched openings in the wall.

The next informative map produced several years later by Thomas Phillips in 1685 depicts less detail but still shows the town as being walled (Fig. 5). There appears to be one less quay located between the second and third archways according to this map, which reappears again on Charles Smith's map produced in 1745. By the time Smith produced the 1745 map, the quay wall had been removed and the pattern, which is still evident today, had begun to emerge (Fig. 6). At the quayside, the street pattern evident from the earlier maps may have been influenced by access to the quay and its gates (Sheehan 1994, 11).

1774 saw the production of Richard's and Scale's 'Plan and City of the Suburbs of Waterford' (Fig. 7). This highly detailed and accurate map shows multiple new additions to the quayside. Ferrybank is denoted on the northern river bank and a ferry pier is illustrated at this location. An interesting observation is that the larger ships are not docking and instead staying in the middle of the river, while the smaller ships are docked up beside the quay. This may indicate a difficulty in landing large vessels along the city's quays; a factor that was most likely due to the presence of tidal mudflats alongside the quay structures and is still an inhibiting factor to shipping today. These tidal issues are highlighted later in seventeenth-century descriptions of the City (Walton 1987, 31–32):

'To this Key are built five most Excellent Miles or Peers which stretch forward into the River about fortie feet in length: between which fortie sail of ships may safely lye, but at Low Water they are aground. But at each of the Miles head, a ship of five hundred tun will lie aflot, and may safely take in her lading, and discharge her freight with Ease.'

The 6-inch OSI map produced in 1871 depicts a series of nine, T-shaped, timber wharf structures extended at right angles from the quays, two from Merchants Quay and seven from Coal Quay installed for ease of access (Fig. 8). The map also depicts the presence of a flour mill on the opposite side of the river and several stores. 'Timbertoes (draw) Bridge', built in 1794 is shown to the northwest of the quayside which was later replaced and is the only fording point across the river in the area. It is also shown with a toll gate at each end. A painting was produced of the quays during the 19th century by Newman. It shows Timbertoes Bridge and vessels in the harbour (Fig. 9). A photograph dating to 1890 taken along Merchants Quay shows vessels moored alongside the T-shaped jetties that extend from the quayside. The large quayside buildings are also noteworthy (Fig. 10).

The 25-inch OSI map published in 1907 illustrates a similar picture but with several structural additions (Fig. 11). A series of eleven wharves now extend from the southern quayside, and a new 'Landing Slip' is shown upstream of Butler Market. The present 'Clock Tower' (NIAH: 22502675) is also now shown at the eastern end of Merchants Quay. In contrast, the adjoining quay (previously Coal Quay) is now subdivided into three quays along its extent, comprising 'Coal Quay', 'Custom House Quay' and 'The Quay'. The series of wharf structures, as previously depicted, appear to remain in situ along Coal Quay. However, these have been extended to form wharves capable of accommodating the multiple-berthing of vessels.

Significant changes are also visible on the north quays particularly with the establishment of the Fishguard and Rosslare Railway Line (1906). Being one of the last significant section of railway to open in Ireland, in contrast to earlier rail developments, concrete was dominant in the building of structures along the line.

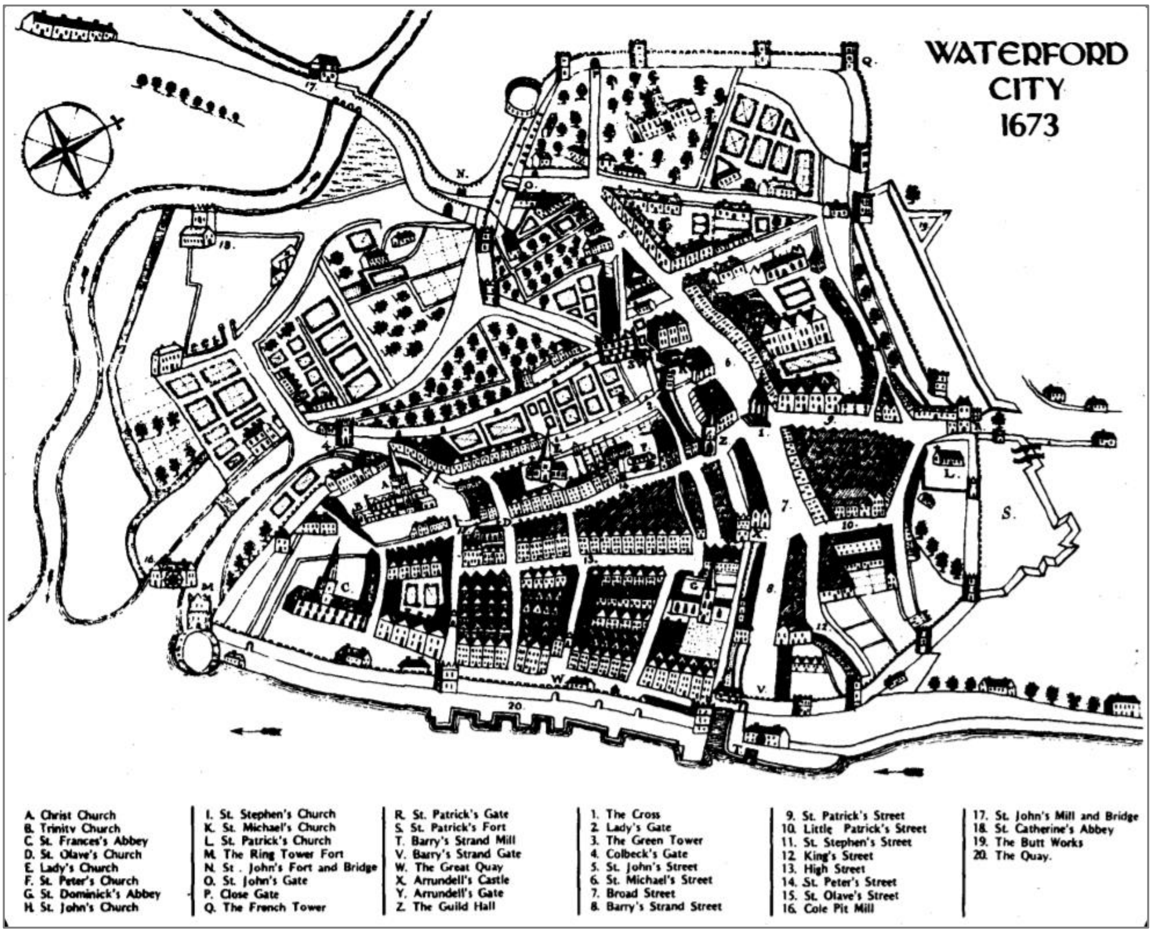

Figure 5: Waterford as it was in 1673 From Rylands 'History of Waterford' (1824).

Figure 6: Map of Waterford by Thomas Phillips 1685.

Figure 7: Charles Smith's map produced in 1745.

Figure 8: Plan and city of the suburbs of Waterford, Richards and Scale, 1764.

Figure 9: Extract from OSI historic 6-inch 1871 map of the proposed development area.

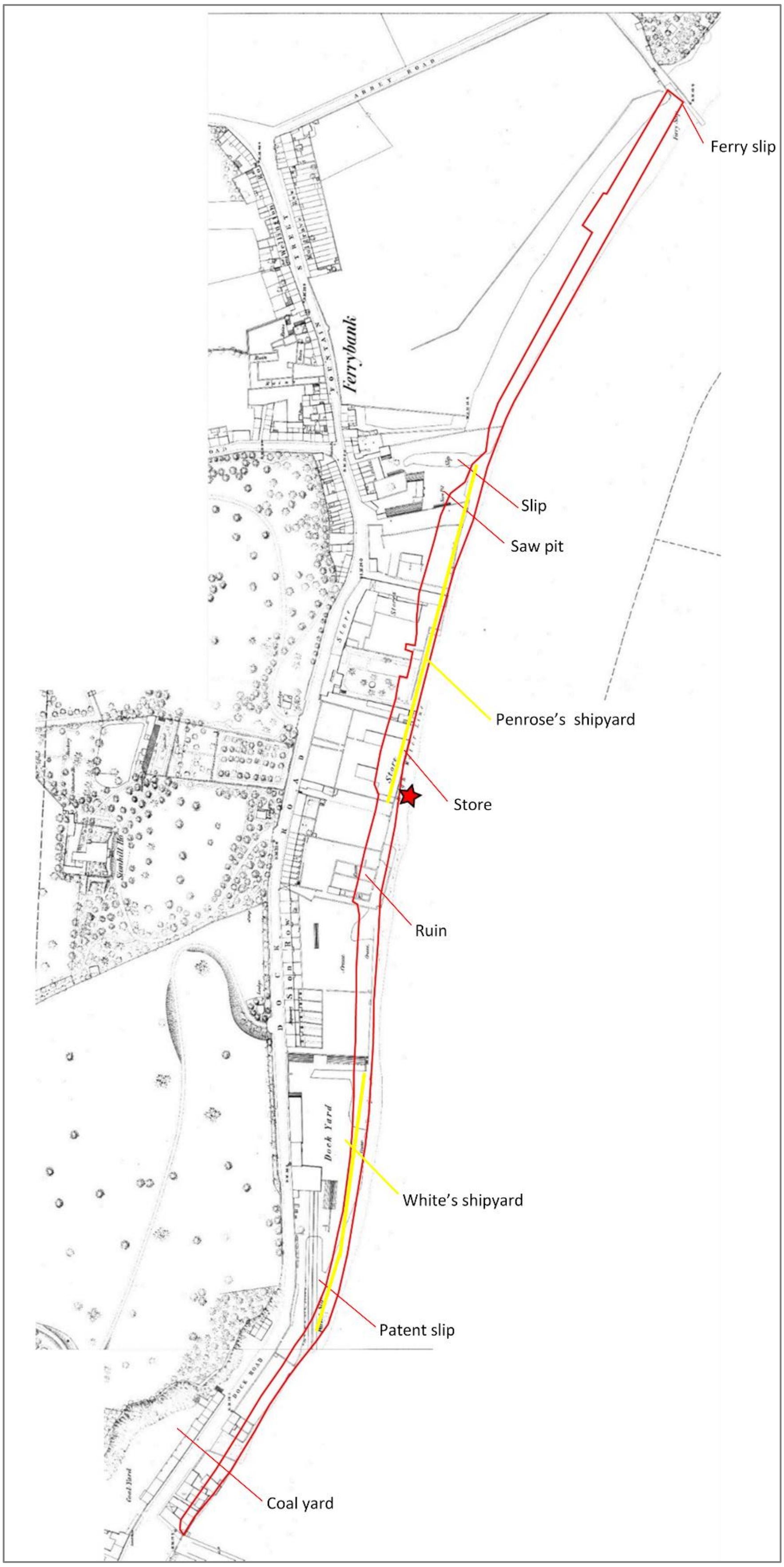

Figure 10: Extract from OSI historic 6-inch map (1871) showing the north quays. Location of proposed bridge indicated with a red circle.

Figure 11: A painting of Waterford Quays by J. Newman & Co., fl. 1838—1880. NLI.

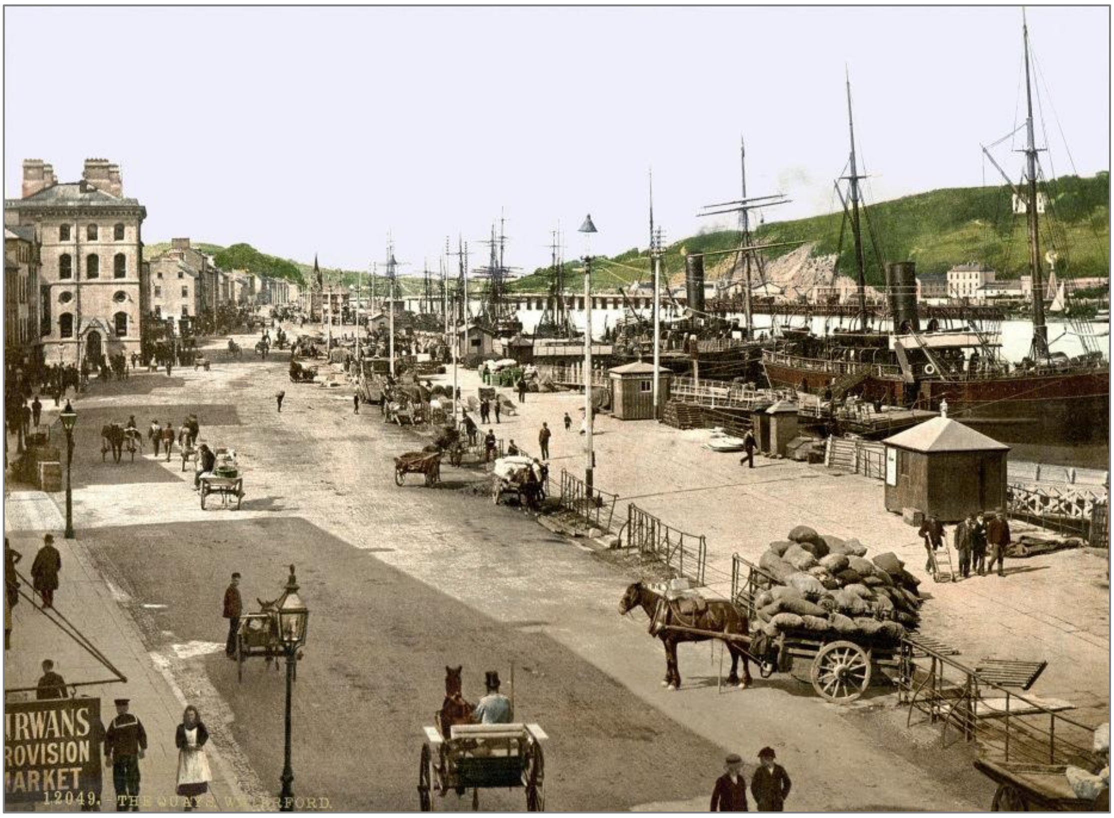

Figure 12: West-facing photography along Merchants Quay taken c. 1890 showing vessel moored alongside the T-shaped jetties that extend from the quayside (Waterford city & county Archive).

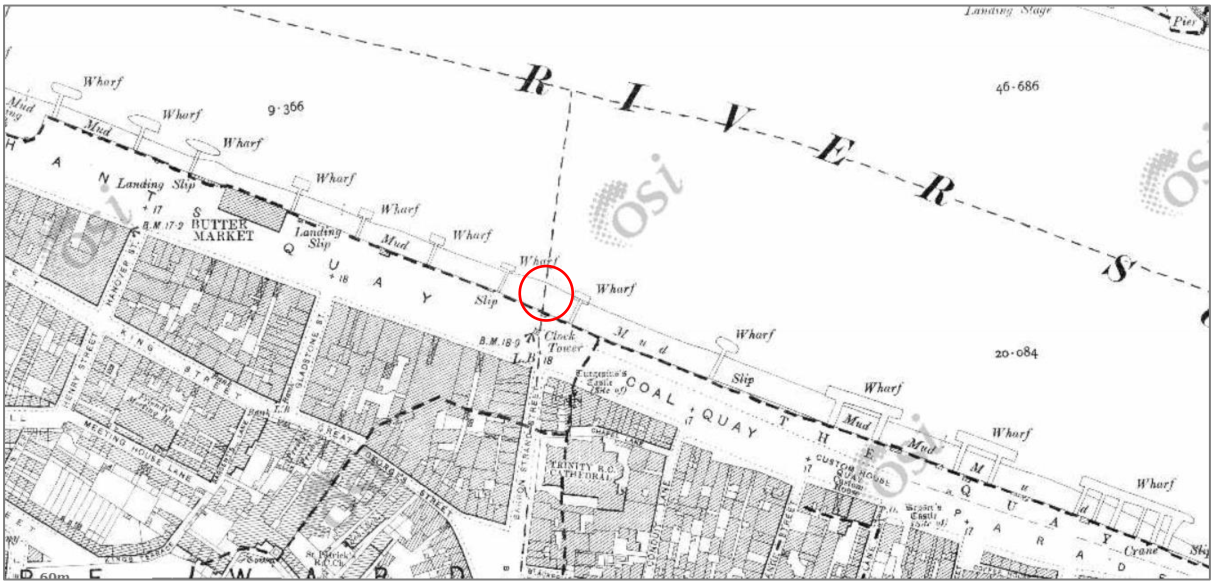

Figure 13: OSI historic 25-inch map of the south quays. Location of proposed bridge indicated with a red circle.

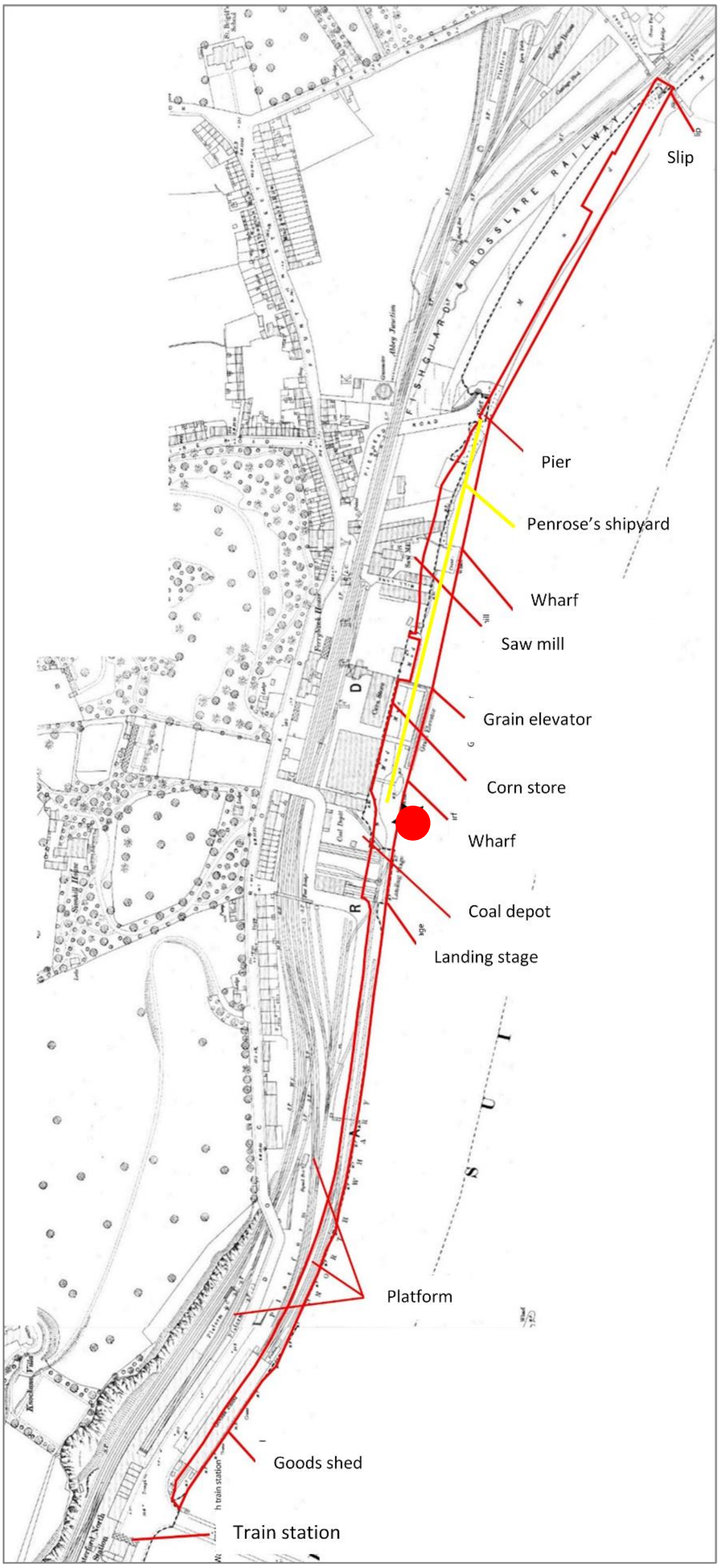

Figure 14: OSI historic 25-inch 1907 with a circle marking the location of the bridge.

5.3 Geophysical Survey

5.3.1 Geophysical survey of River Crossing

Hydromaster were commissioned by Mizen Archaeology to undertake an acoustic and magnetic survey of the proposed river crossing during September 2018 (Appendix 3).

Twenty-six acoustic targets (D1 – D26) were detected by the multibeam echo-sounder, and a further twenty-eight magnetic targets (M1 - M28) were detected by the magnetometer (Figure 15). Six of the magnetometer targets coincided with the acoustic data (M4 & D22, M9 & D24, M21 & D5, M32 & D16, M33 & D15 and M36 & D23), indicating that the remaining twenty-two magnetic targets could potentially be buried ferrous material.

None of the acoustic and magnetic anomalies are located within the footprint of the proposed bridge piers. Only six acoustic targets and five magnetometer targets were identified within 20m of the proposed crossing.

Acoustic targets D1, D4, D5, D6, D7, D15, D16, D17, D19, D20, D21, D24, and D26 all have similar characteristics and dimensions. All of these anomalies have the appearance of very narrow long object such as a cable. They are located on a flat area of the riverbed, have no associated scouring and only one (D5) produced a magnetic reading. D15, D21 and D24 was selected for dive inspection as a representative sample from this group due to their proximity to the proposed crossing.

Acoustic targets D2, D12, D14, D23, and D25 also share similar characteristics and dimensions, being long, narrow or cylindrical in shape. D23 was selected for further investigation due to its proximity to the proposed crossing.

D8, D9, D10, D11, D13, D18, and D22 presented in the acoustic data as amorphous debris on the riverbed. D10, and D22 were selected for the dive truthing due to their proximity to the crossing.

5.3.2 Geophysical survey of area of proposed quay development

An acoustic survey was undertaken on the footprint of the proposed development of the north quay, producing an image of the river bank strewn with debris (Figures 16-25). It also captured the upstanding elements of the concrete quays.

5.4 Dive Survey

5.4.1 Dive survey of River Crossing

The dive truthing survey of the anomalies was undertaken by a five-person team including dive supervisor, dive tender, stand-by diver, archaeological diver and archaeological supervisor (Plate 2). A surveying engineer located the anomalies using a Trimble 5800 DGPS with <8mm accuracy. At the time of the survey water depths varied between 2m and 12m. The high turbidity level resulted in near zero visibility during the dive survey. Underwater torches provided close-up view of features on the riverbed. Where anomalies were not immediately found a circular dive search encompassing a diameter of c.10m was undertaken.

The geophysical survey identified no anomalies within the footprint of the proposed bridge piers. Twenty-six acoustic and twenty-eight magnetometer targets were detected in the wider survey area (Figure 15). Six acoustic targets and five magnetometer targets were identified within 20m of the proposed crossing. Following consultation between *Mizen Archaeology* and the *Underwater Archaeology Unit of the National Monuments Service*, it was decided to investigate a sample of the anomalies identified as debris in the geophysical survey including all those occurring within 20m of the proposed crossing.

A dive inspection of the features identified no features of archaeological significance. As expected the diver surveys confirmed the presence of debris of similar estimated dimensions to those measured from the multi-beam data and included a concrete pipe, concrete bollards, wooden pile, metal pipe, scaffolding bar. None of the objects were in-situ. They may have originated from the quay structures

5.4.2 Dive survey along North Quay

The riverbed survey at the North Quay was undertaken by a five-person team including dive supervisor, dive tender, stand-by diver, archaeological diver and archaeological supervisor (Plate 10). The visibility was also near zero in this area and underwater torches were utilised for close-up view of features on the quay wall and riverbed. In contrast to the coarse sediment observed in the channel, the northern part of the riverbed consists of soft mud resulting from the lateral deposition of riverine silt. The metal detection survey was of limited benefit due to the high quantity of metal in the surrounding quay structures. A large quantity of modern metal objects were identified including steel shackles, iron bolts and brackets and scaffolding bars.

A 540m long concrete quay (known as the North Quay) is positioned at the western limits of the survey area, adjacent to northern abutment of Edmund Rice Bridge (Figure 2). The quay is comprised of concrete decking supported on concrete piles. It is protected by fenders consisting of wooden vertical piles and horizonal braces. The quay is in a state of disrepair and in particular the wooden fenders are considerably degraded.

Behind this concrete quay are the remains of an earlier stone quay wall extending for c.480m from the bridge. The location and extent of the stone quay was plotted with the DGPS and a sample section was photographed and drawn (Figure 16). The stone quay measures between 2.1m and 2.8m in height above the adjacent riverbed. It is constructed coursed squared limestone blocks. It contains multiple culverts and iron mooring rings. Some of the original timber fenders survive albeit in a very poor state of preservation. Multiple repairs and rebuilding phases are visible on the quay wall.

26m to the east of this, is the site of the recently demolished R & H Hall flour mill building. Constructed in 1905-6, it consisted of a nine-storey grain store and associated concrete quay. The H&R Quay, a concrete pile and deck structure remains in-situ. No evidence of any earlier quay structures was visible beneath the concrete quay.

Immediately east of the H & R Quay is a very silted up area of the riverbank. This mudflat is exposed at low water. The fragmented remains of a timber landing stage (plate 4) survive here. The structure is not shown on the 1st edition Ordnance Survey map of 1871 but is illustrated on the 2nd edition map of 1907. In addition to the erect wooden piles, several loose timbers which may have formed part of the landing stage or may have floated downstream from another structure were noted beside the structure as well as branches of trees and other debris.

163m to the east of the R&H Quay is a third quay consisting of concrete deck supported on concrete piles (Frank Cassin Wharf). The inspection of this area of the riverbed has hampered by the presence of a large moored ship and tug vessel. As a result, only the western end of the quay was inspected. Nothing of archaeological significance was recorded on the riverbed. Steel rope, tyres and modern construction timber was noted. The construction of this modern quay facility appears to have subsumed the earlier slip and landing area of Ferry Bank.

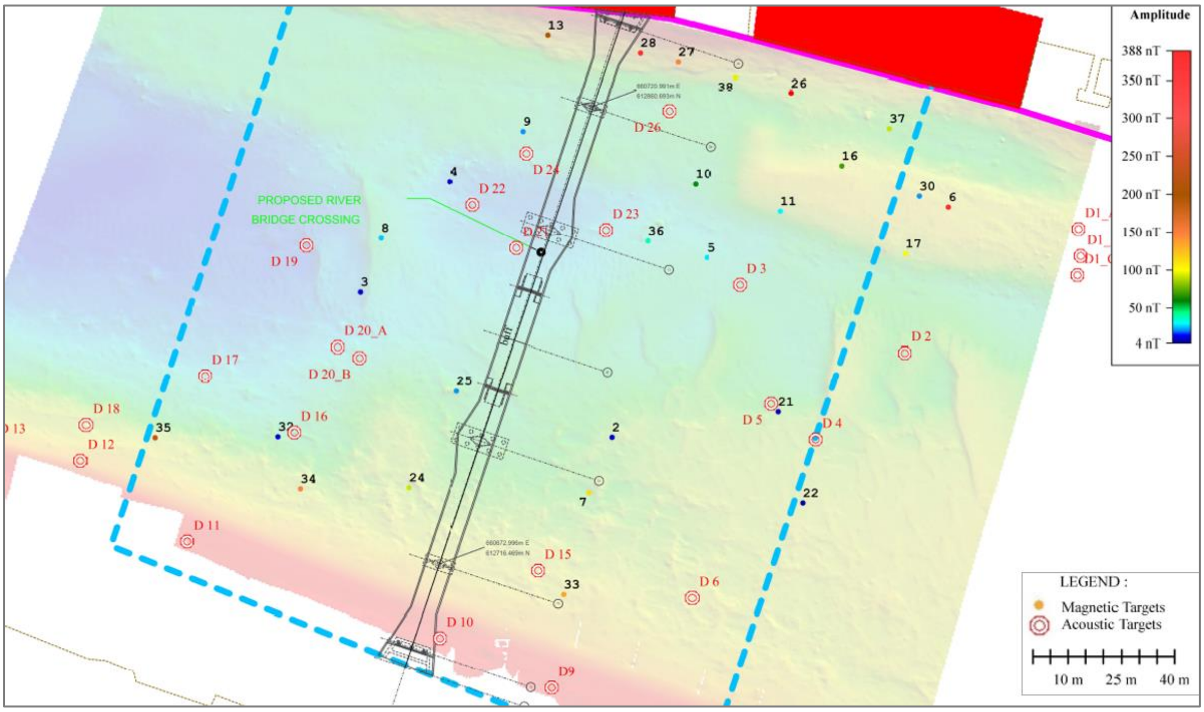

Figure 15: Map showing acoustic and magnetic targets at proposed river crossing.

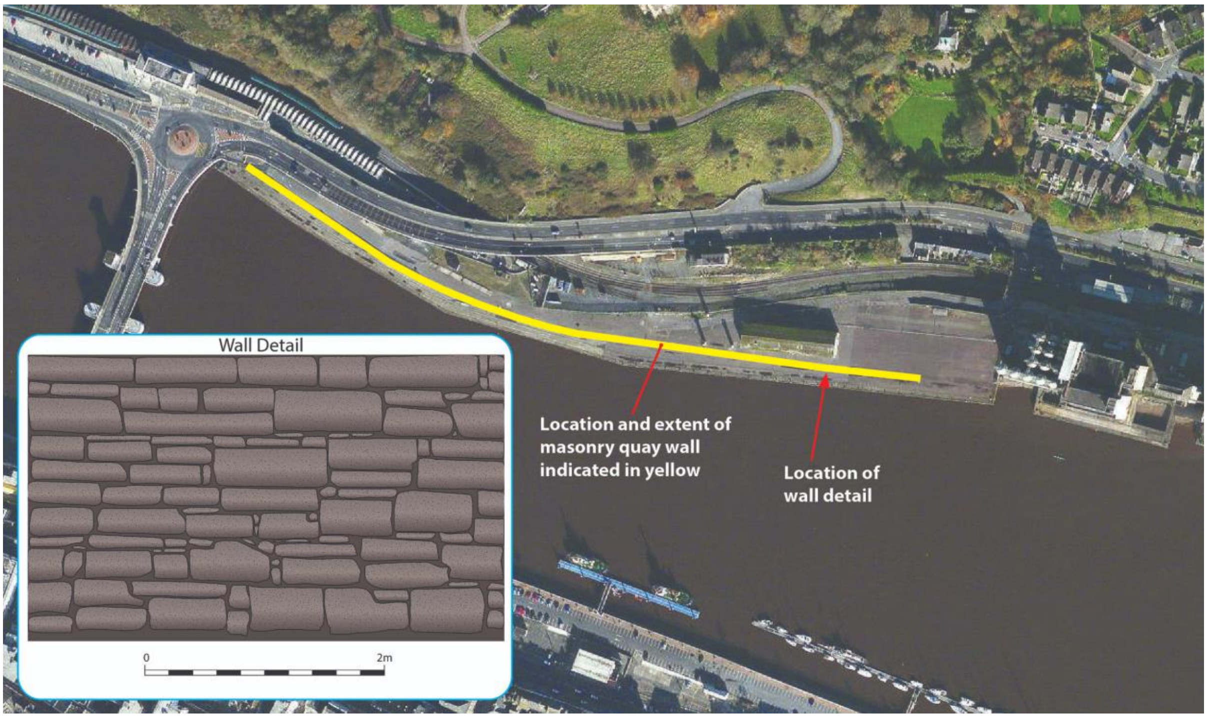

Figure 16: Location and close-up detail of stone quay behind the concrete quay.

Plate 1: Image of diver at the stone quay behind the concrete quay.

Plate 2: Dive survey in progress

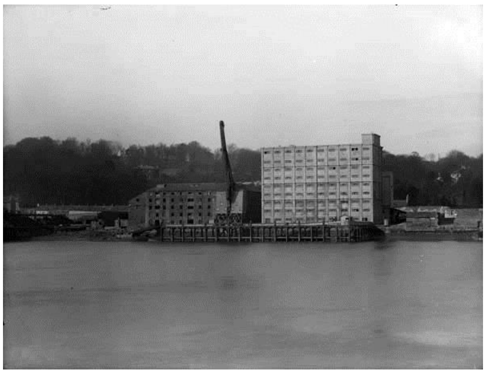

Plate 3 & 4: Image of H & R building from the Poole Collection at the National Library, and it's present state.

Plate 5: Image of eastern limits of survey area.

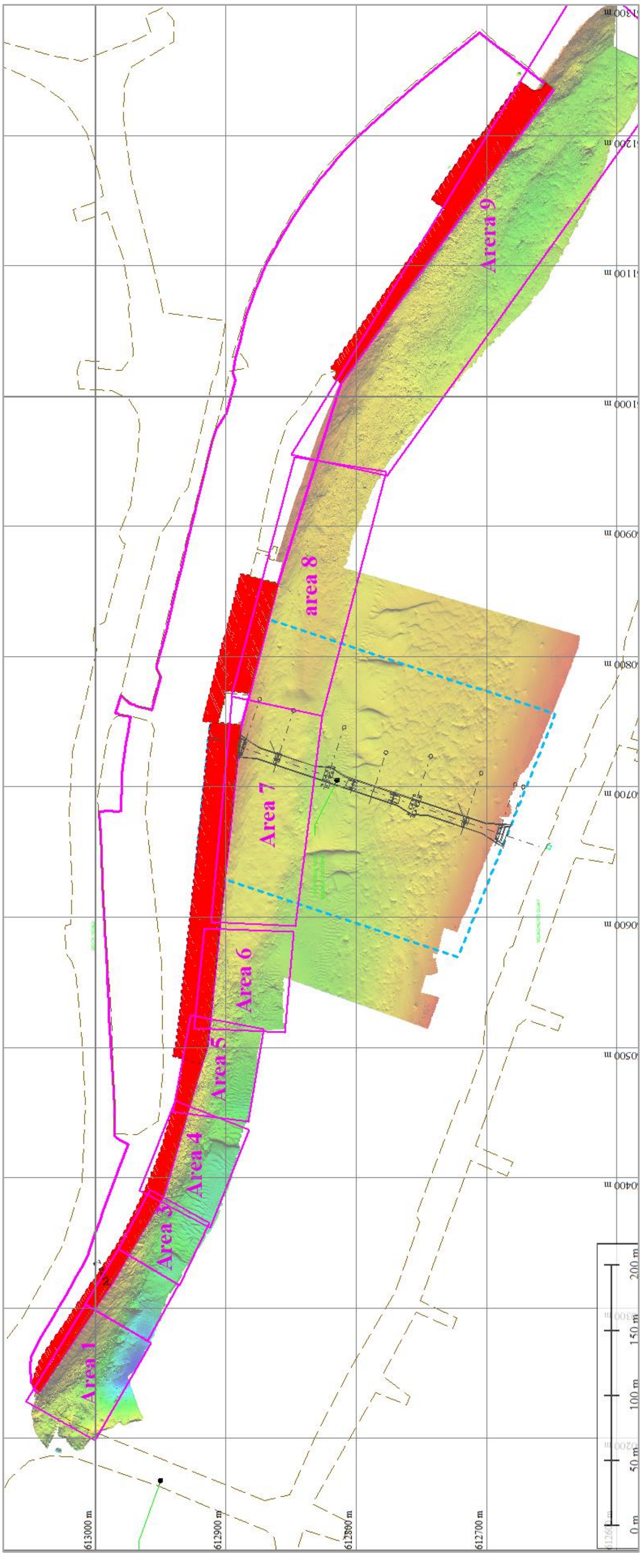

Figure 17: Extent of Geophysical survey, with multi-beam image of North Quay divided into nine areas

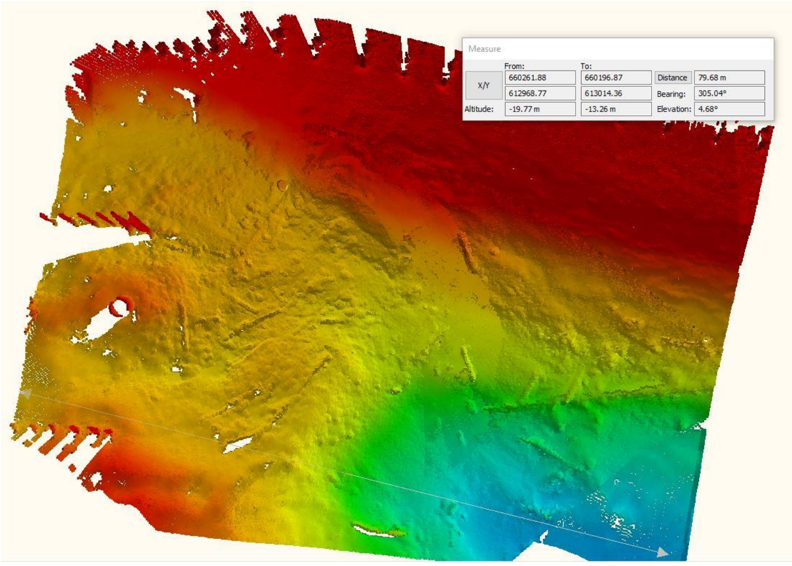

Figure 18: Multi-beam image of riverbed at North Quay, area 1.

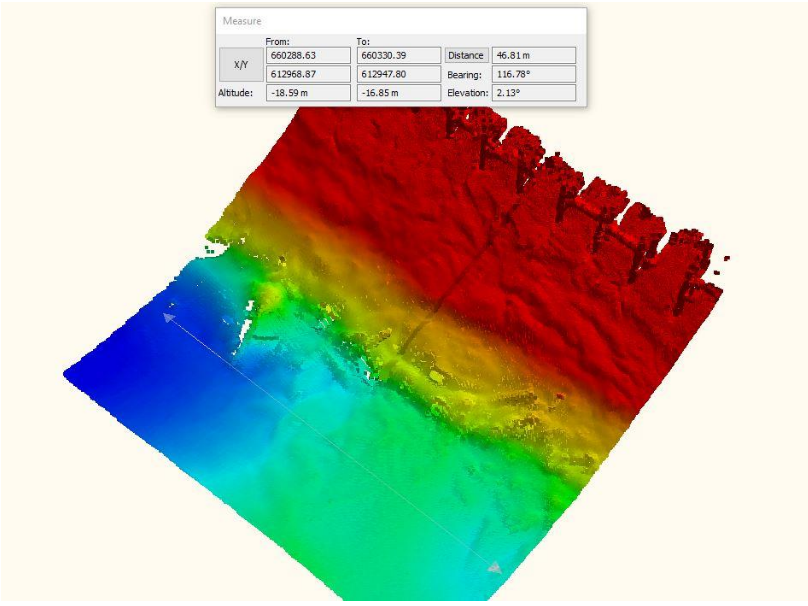

Figure 19: Multi-beam image of riverbed at North Quay, area 2.

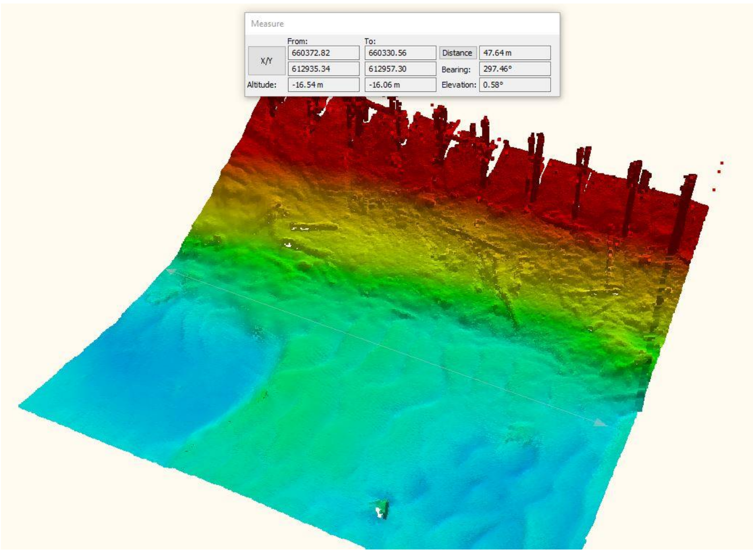

Figure 20: Multi-beam image of riverbed at North Quay, area 3.

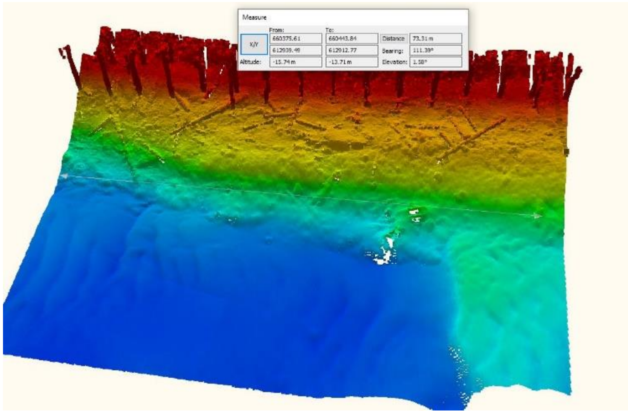

Figure 21: Multi-beam image of riverbed at North Quay, area 4.

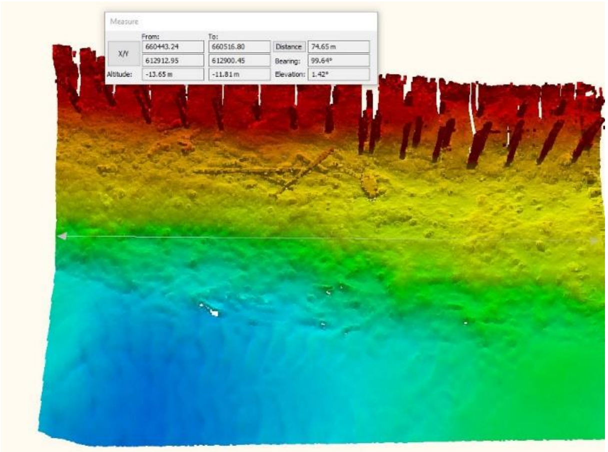

Figure 22: Multi-beam image of riverbed at North Quay, area 5.

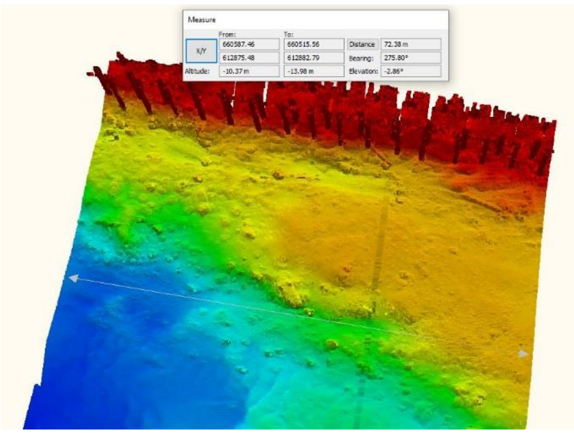

Figure 23: Multi-beam image of riverbed at North Quay, area 6.

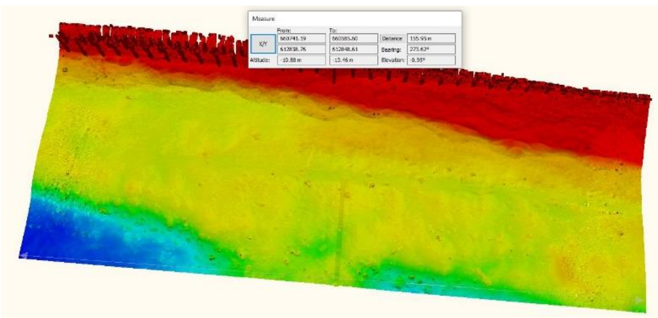

Figure 24: Multi-beam image of riverbed at North Quay, area 7.

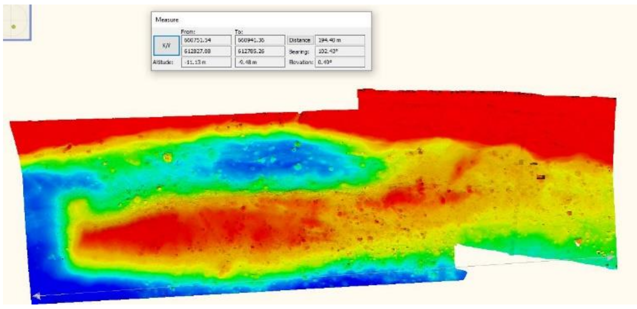

Figure 25: Multi-beam image of riverbed at North Quay, area 8.

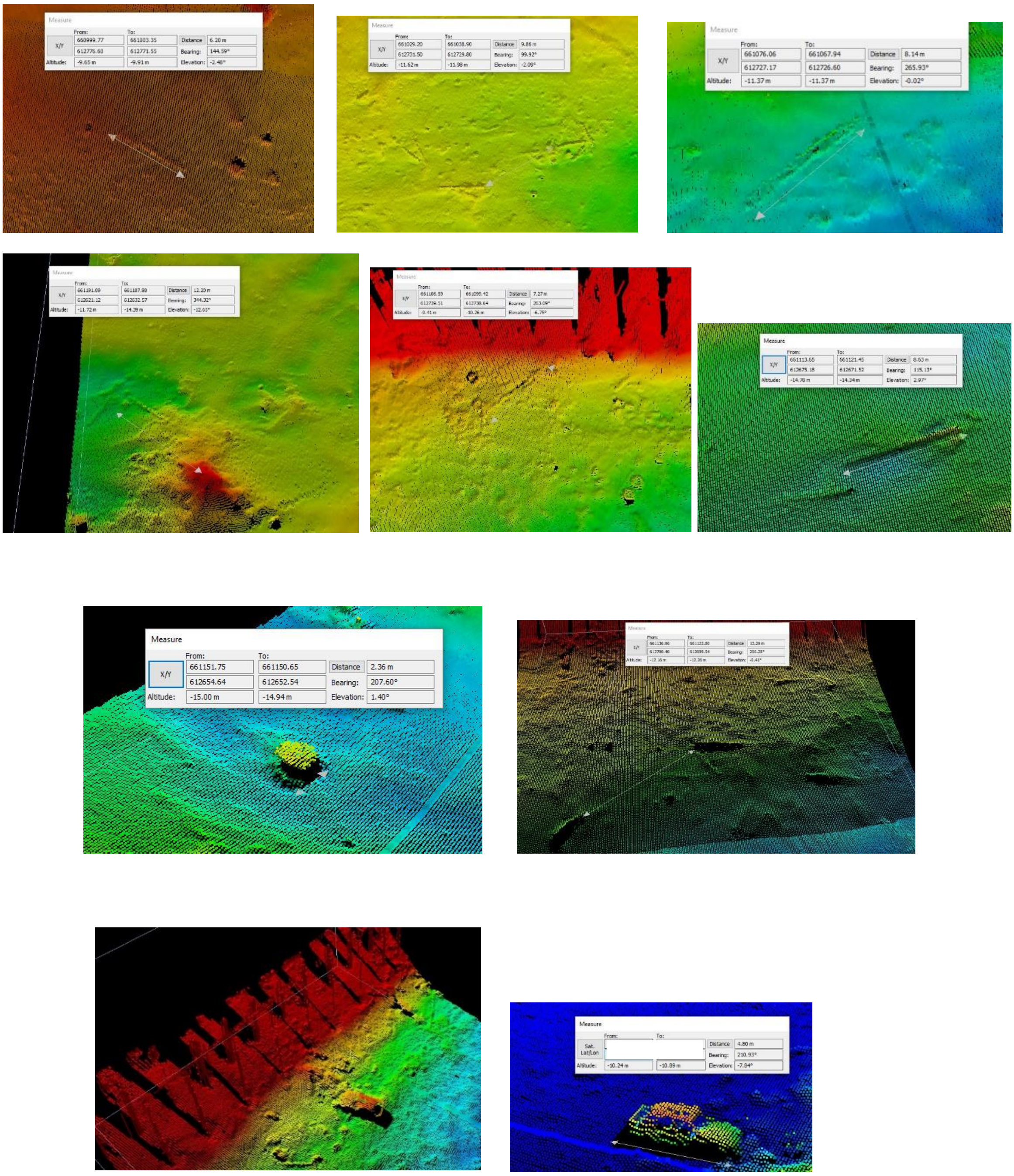

Figure 26: Multi-beam images of debris on the riverbed at North Quay, area 9.

5. Conclusion

The development of the northern bank of the River Suir constitutes a significant period of Waterford's maritime history. The North Quays were modified over time in response to the City's economy. They developed in the 18th Century as an expansion of the working port on the southern riverbank and facilitated shipyards, river and rail transport. The original quay and pier structures have been subsumed by later 19th and 20th Century structures, most of which have themselves fallen into disuse.

There are no known recorded archaeological monuments within the study area. No new archaeological sites were discovered in the geophysical and dive survey. The Inventory of Shipwrecks of Ireland does not contain any reference to wrecking events for this area of the Suir River, nor does the topographical files of the National Museum of Ireland list any artefacts for this location. However, there is potential for buried archaeological material including shipwreck components to be preserved in the riverine sediment.

6. Mitigation

- Photogrammetry of the stone quay at the western limits of the North Quay landing point of the proposed development should be undertaken in advance of the commencement of construction works (Fig. 16).
- All excavation works should be archaeologically monitored by experienced, licensed underwater archaeologists with a proven track record in equivalent, similar type work.
  Should archaeological material, wreckage, timbers or other artefacts be recorded in the course of the monitoring, the archaeologist will be empowered to recover and record the material. This may involve the temporary suspension of the work to recover the material. In the event that excavation works impact on an archaeological site, the standby archaeological dive team, in place for such eventualities, should be mobilised to undertake a dive inspection of the impacted site which may lead to further investigations and / or potentially full excavation.

7. Bibliography

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8. Appendices

8.1 Previous Archaeological Investigations

Location: 66 Meagher's Quay, Waterford

Licensee: Sarah McCutcheon, 97E0479

Description: Archaeological monitoring for redevelopment not uncover any did archaeological remains, apart from sherds of $17^{th}/18^{th}$ century English black-glazed earthenware.

Location: John's River to Hardy's Bridge, Waterford

Licensee: Cóilín Ó Drisceoil, 09E0143

Description: Archaeological monitoring on Adelphi Quay for Waterford flood-alleviation scheme uncovered mooring posts and chains, a crane pad and cobbled surfaces were recorded, all of which were marked on the 1870 OS map of Waterford and relate to the steam-packets which served Cornwall from this dock.

Location: Waterford Quays

Licensee: Niall Brady, 00D067

Description: Quayside reclamation works did not uncover any archaeological remains however, it was possible to observe sections of the historic quay wall; forming part of the quayside that delineated Merchants Quay in the nineteenth-century. The visible sections of quay façade comprised up to ten courses of masonry; ranging in size from between 500mm and 1.6m length by 260mm and 330mm width. A series of three greenheart timber piles were also present, positioned approximately mid-way along the quayside area, placed to consolidate the quay at a point where previous collapse of the quay's façade had occurred. A small arched-culvert, measuring 1.m height x 720mm width, was also noted, located towards the western extent of the quay structure. A number of wrought-iron mooring hoops were also located along its extent. A bed of modern reinforced concrete has been used to cap the upper surface of the quayside, mounted by an openwork guard rail.

Location: Waterford Quays

Licensee: Rex Bangerter, 17D0025

Description: An archaeological dive survey was undertaken as part of a proposed bridge located in front of the Clock Tower crossing the River Suir. The assessment has confirmed that sections of historic quay and associated timber wharfing, as depicted on the OS 25-inch map, remain in situ on the north side of the river channel; located beneath the existing concrete quay that currently delineates this side of the river. In addition, the potential for riverbed deposits to retain material of archaeological significance is highlighted by the presence of wreck related material encountered during the riverbed inspection of Survey Area 5; located at a point 5.5m southwest of the proposed location of Pier E. This material comprises two planking timbers and the part of a rigging-block from a sailing vessel.

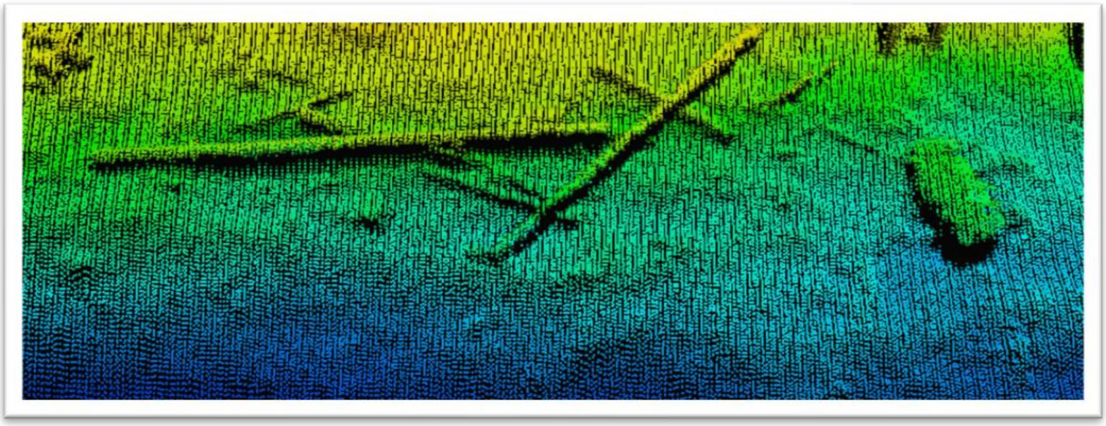
8.2 Record of piers and harbours

"At Waterford, a capacious natural harbour, considerable exertion has been made to deepen the Ford and obtain a channel up to the town; but an extensive mudbank still lines the foor of the finest range of quays in the United Kingdom; the soil, dredged up in one part of the harbour, is dropped into the stream in another; thousands of tons of refuse stone are annually swept into the river from the quarries at Granagh; while the bridge, with its 36 arches and corresponding piers, and an opening for ships only ten yards wide, places a bar to the extension of navigation and improvement towards Carrick - on Suir and Clonmel."

Second Report of the Commissioners appointed to inquire into the State and Condition of the Tidal and other Harbours; Shores and Navigable Rivers of Great Britian and Ireland. CSP 1846, Vol. XVIII, Pg. vi-vii.

8.3 Geophysical survey Report

Waterford Archaeo-Geophysical report



NOTES

Project	Waterford North Quay Redevelopment
Survey type	Geophysical (Multibeam and Magnetometer)
Survey date	03/07/2018 and 04/09/2018
Revision	Rev 1 (magnetometer part)

Report date	07/09/2018
Location	Waterford

Hydromaster Ltd. 7 Howley Court, Dublin Road Oranmore

Co. Galway, Ireland

Tel: +353-86-0891047

E-mail: bsmith@hydromaster.ie

Projection	ITM

Contents

1. Introduction

Hydromaster undertook an Acoustic and Magnetic survey in Waterford docks the 3rd and the 4th of September 2018.

The survey area took place at the future bridge location in Waterford, between the North and South Quay (figure 1 – pink boundary).

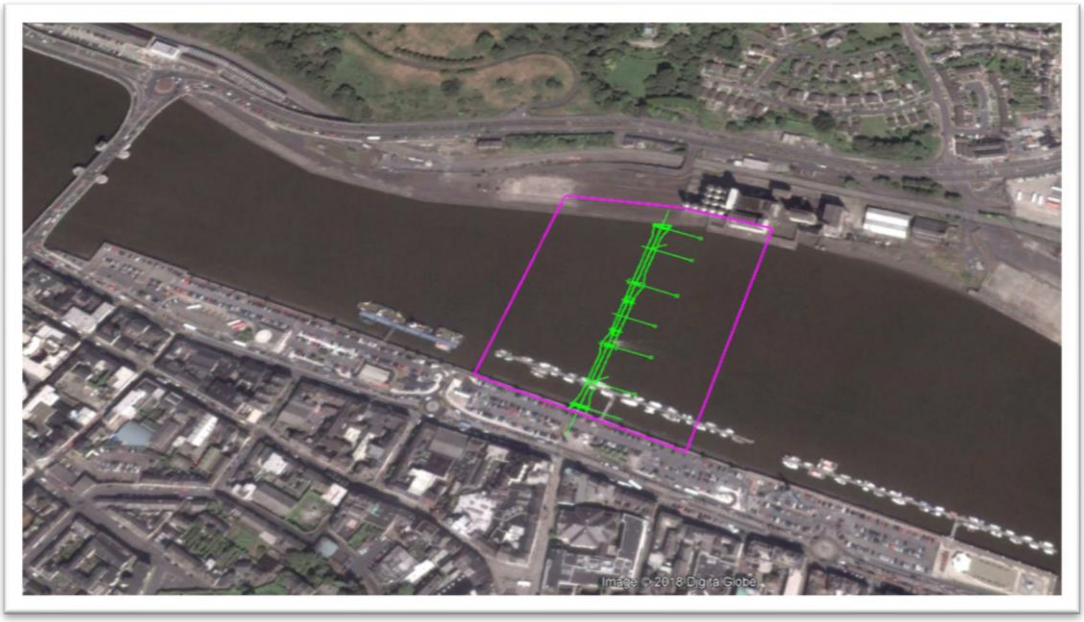


Figure 1: Geophysical survey extent (pink area) with the proposed bridge (green) - Waterford (Google Earth picture)

2. Equipment used

2.1 Multibeam Echo-sounder

The acoustic survey was conducted with a Reson Teledyne T-50 P Multibeam, ultra-high resolution Multibeam Echosounder. The following table sums up the T-50P specifications:

Table 1: Multibeam specs

T50 Acoustic Performance	400 kHz (max.frequency)
Across-track receiver beam width	0.5°
Along-track beam width	1°
Number of beams	Min10, Max 512
Swath coverage (up to)	150° Equi Distant, 165° Equi angle

2.2 Magnetometer

The magnetic survey was conducted with a Marine Magnetics SeaSPY Magnetometer, well suited for the detection and mapping of all sizes of ferrous objects. The following table sums up the SeaSPY magnetometer specifications:

Table 2: Magnetometer specs

Absolute accuracy	0.1 nT
Counter sensitivity	0.001nT
Resolution	0.001nT
Sampling Range	4Hz to 0.1Hz

3. Acoustic survey result

In total, 26 acoustic targets have been detected by the multibeam echo-sounder, as shown in the following chart. Those targets have been listed in the table 3.

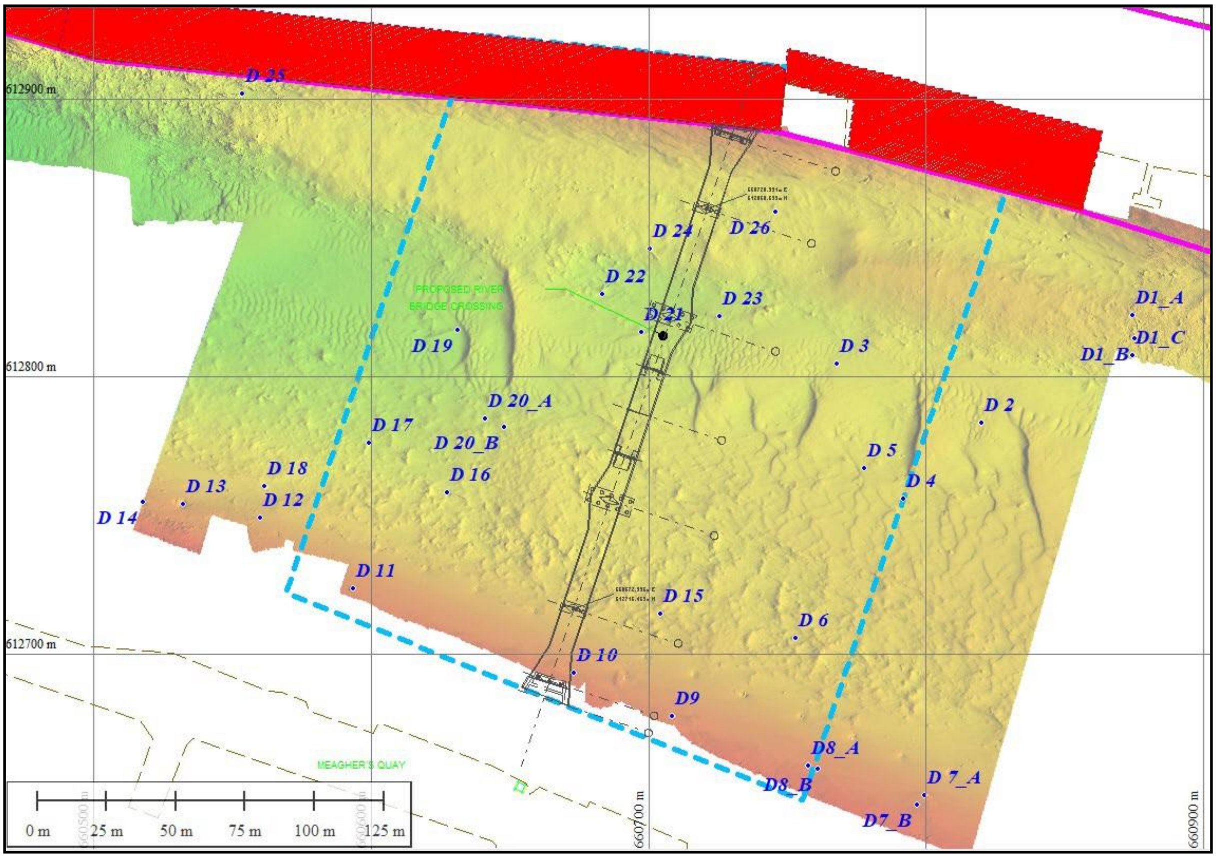


Figure 2: Acoustic targets location - July 2018 survey - Waterford

3.1 Acoustic targets coordinates

Table 3: Acoustic targets coordinates (ITM) and description

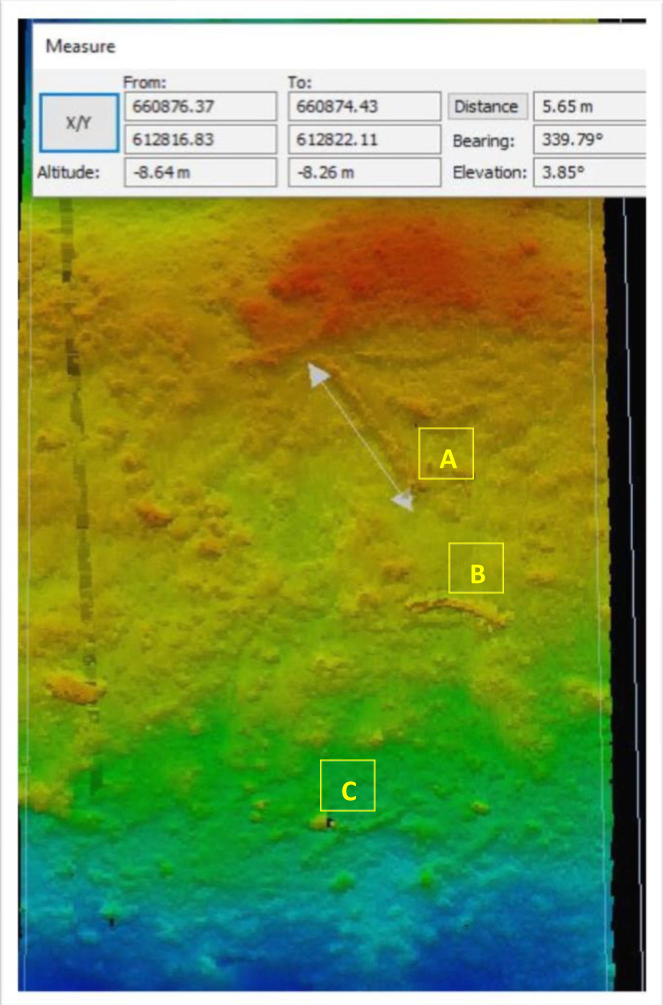
E	N	length	depth OD (m)	depth CD (m)	debris #	description
660874.6	612822.2	5.5	8.2	5.4	debris1_A	NI – long object
660875.3	612813.7	3.3	8.3	5.5	debris1_B	NI – long object
660874.3	612807.6	3.9	9.0	6.2	debris1_C	NI – long object
660820.0	612783.2	3.5	9.6	6.8	debris 2	NI – long object
660767.9	612804.5	1.0	10.8	8.0	debris 3	NI – debris
660791.8	612755.9	3.7	9.5	6.7	debris 4	NI – long object
660777.7	612767.2	2.9	9.7	6.9	debris 5	NI – long object
660752.9	612705.8	2.9	8.7	5.9	debris 6	NI – long object
660799.3	612649.1	2.0	3.7	0.9	debris 7_A	NI - debris
660796.9	612645.5	1.8	3.0	0.2	debrisi7_B	NI – couple of long objects
660757.5	612659.7	1.0	2.9	0.1	debris8_A	old anchor block
660761.0	612658.4	1.0	2.7	-0.1	debris8_B	old anchor block
660708.6	612677.7	1.3	3.0	0.2	debris9	NI - block
660673.3	612693.3	1.2	3.0	0.2	debris 10	NI – block
660593.6	612723.6	1.0	2.4	-0.4	debris 11	NI - block
660560.1	612749.2	3.0	6.0	3.2	debris 12	NI - debris
660532.3	612754.2	1.5	4.7	1.9	debris 13	small pile
660518.1	612754.8	3.5	4.0	1.2	debris 14	NI - pipe
660704.3	612714.4	5.2	8.5	5.7	debris 15	NI – long object
660627.5	612758.1	8.3	10.4	7.6	debris 16	NI – long object
660599.3	612776.0	10.0	11.4	8.6	debris 17	NI – long object
660561.8	612760.5	1.0	8.6	5.8	debris 18	tyre
660631.3	612817.0	7.7	14.0	11.2	debris 19	NI – long object
660641.2	612785.0	4.3	12.0	9.2	debris 20_A	NI – long object
660648.1	612781.7	3.8	11.0	8.2	debris 20_B	NI – long object
660697.4	612816.2	4.0	11.4	8.6	debris 21	NI – long object + debris
660683.5	612829.9	4.5	11.4	8.6	debris 22	NI – long object
660725.8	612821.9	5.2	11.3	8.5	debris 23	NI – long object
660700.6	612846.1	5.4	11.0	8.2	debris 24	NI – long object
660553.6	612902.2	7.6	10.0	7.2	debris 25	NI – long object + debris
660745.9	612859.4	13.0	10.0	7.2	debris 26	cylindrical debris

NI= Non Identified

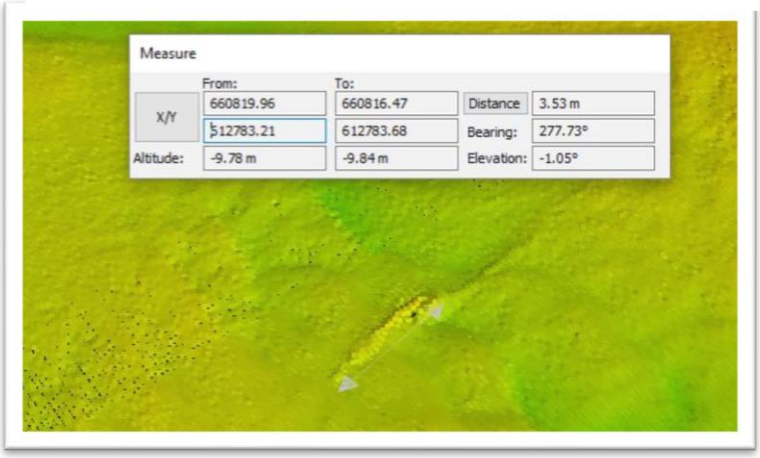
3.2 Acoustic target data

Multibeam data of each targets is shown in this section. Note that the "altitude" on the pictures is in OD Malin head and that the coordinates X and Y are in ITM.

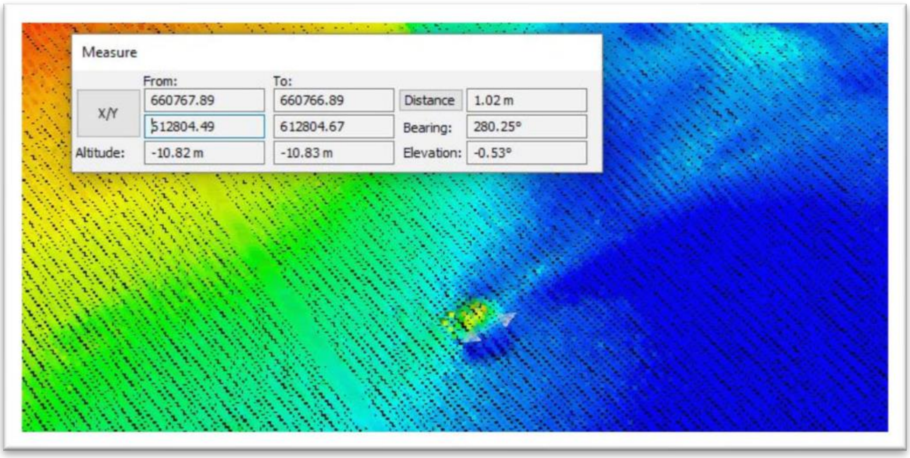
Debris 1 A, B anc C



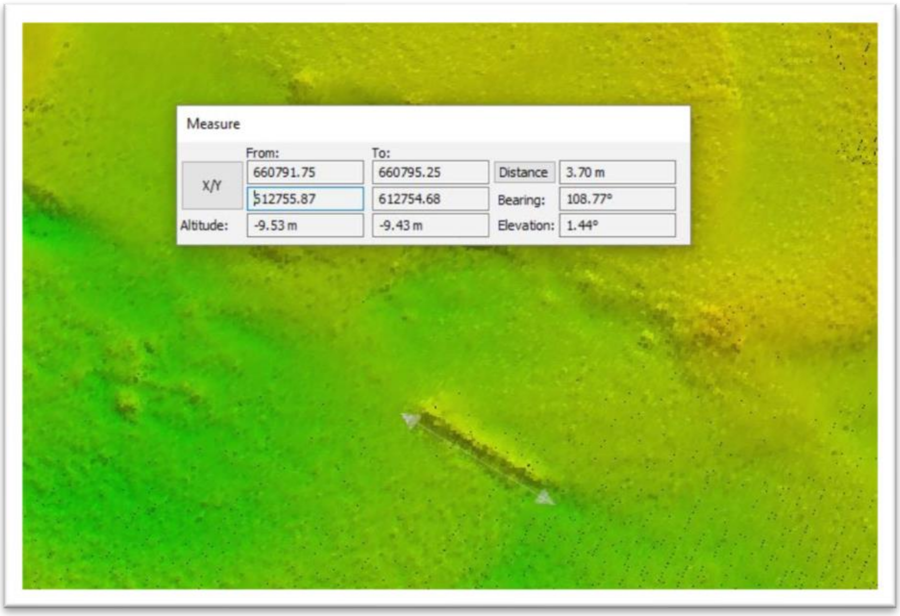
Debris 2



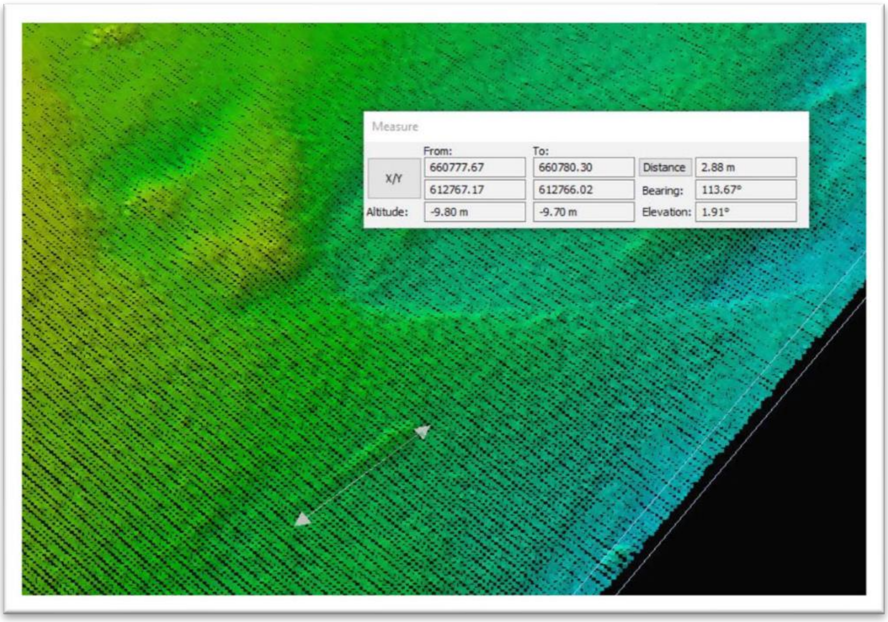
Debris 4



Debris 4

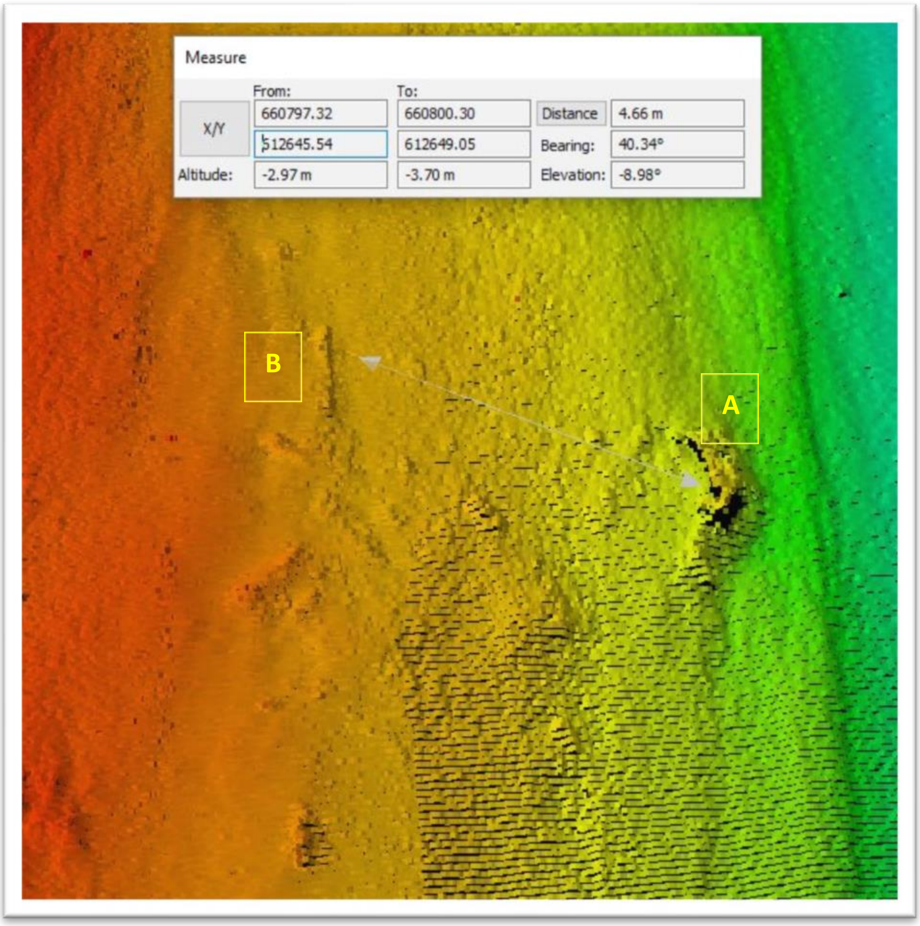


Debris 5

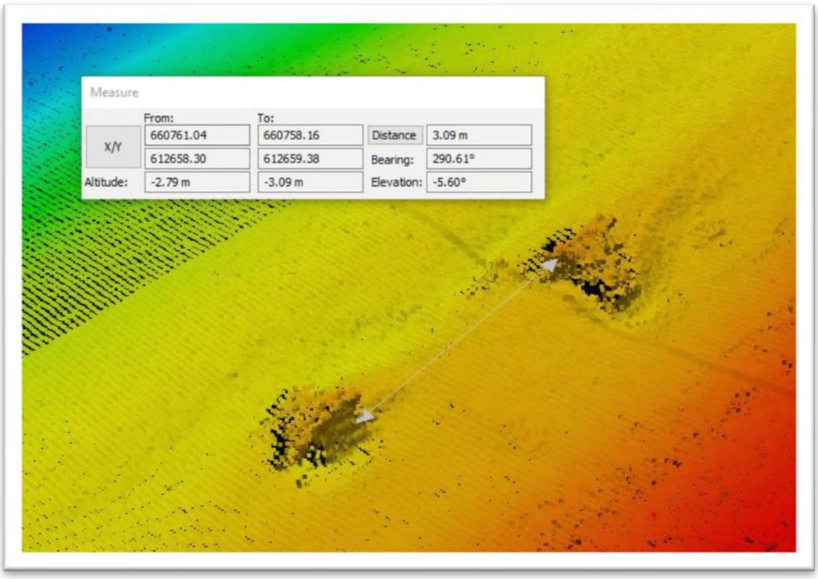


Debris 6

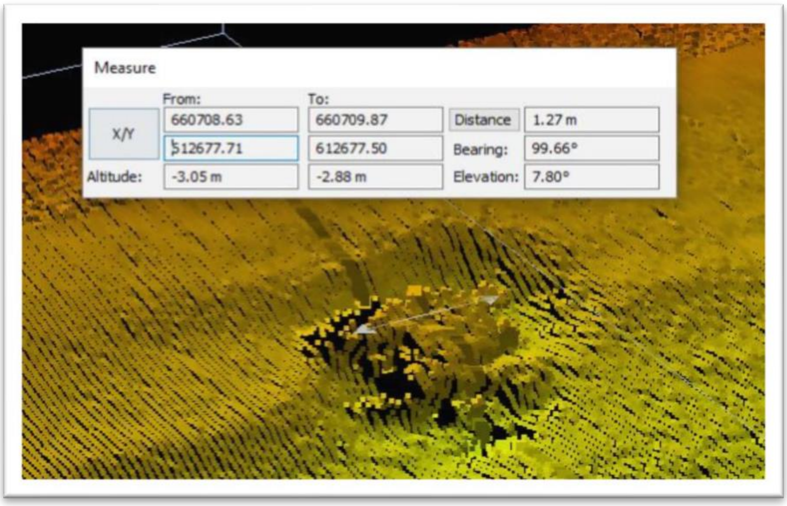
Debris 7 A and B



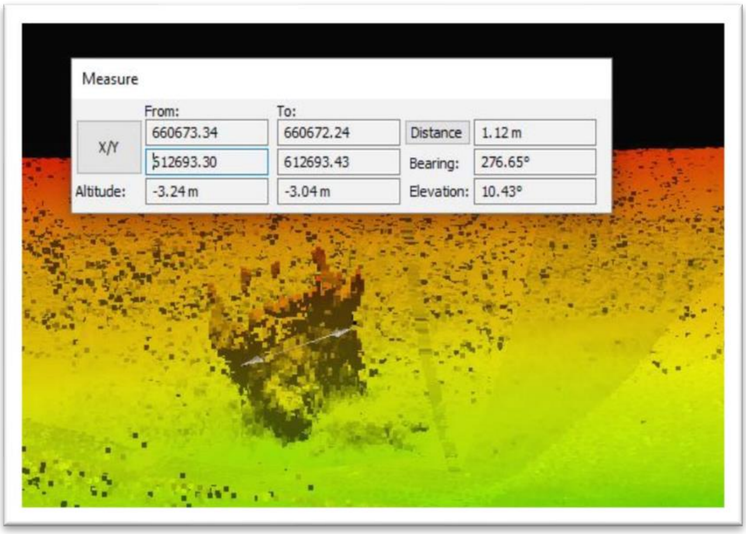
Debris 8



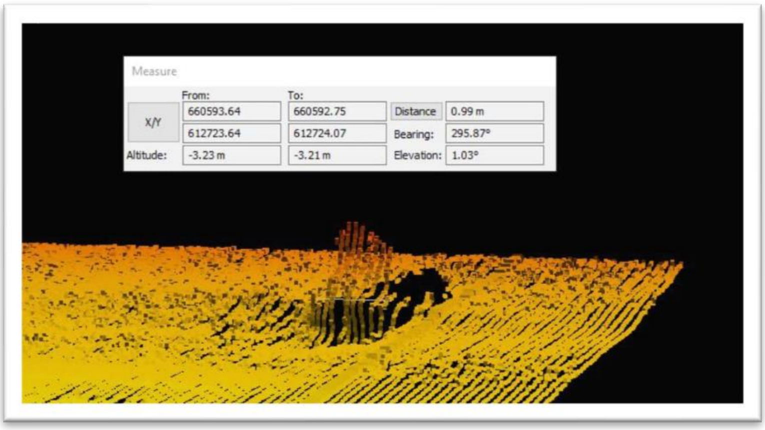
Debris 9



Debris 10



Debris 11



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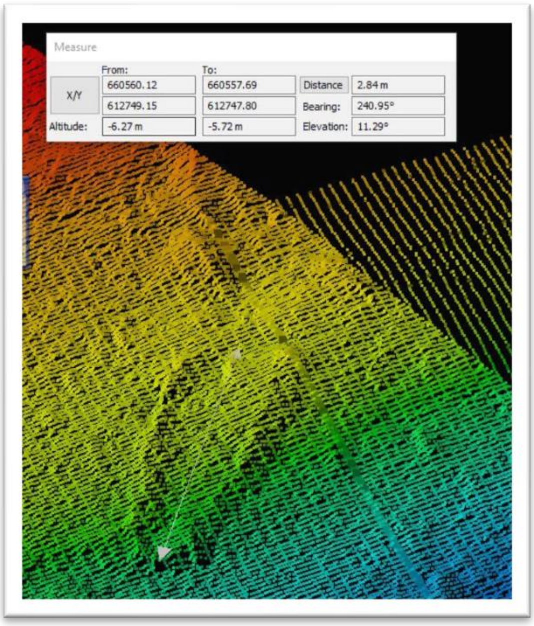

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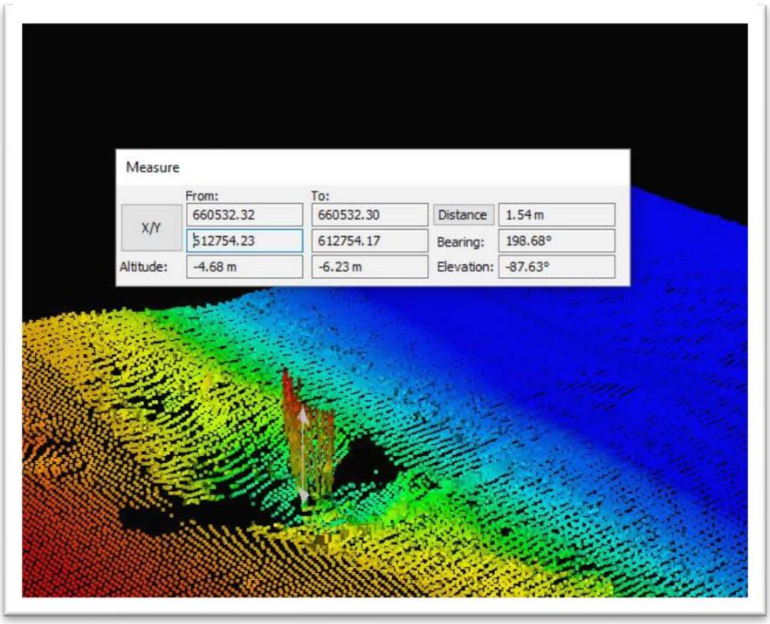

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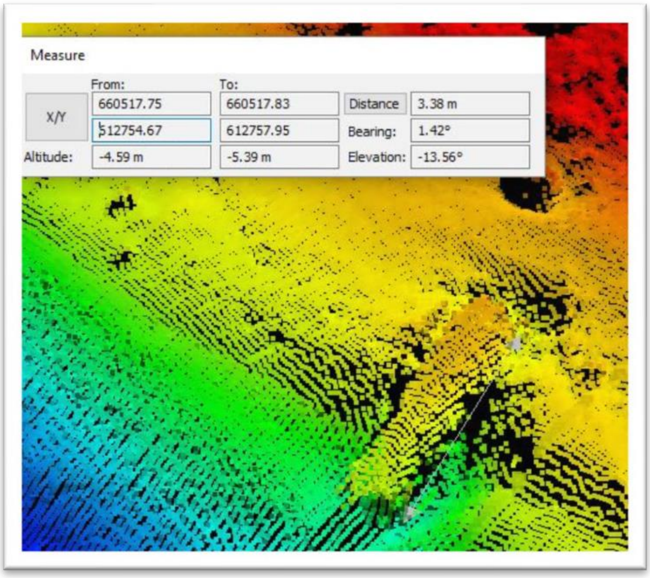
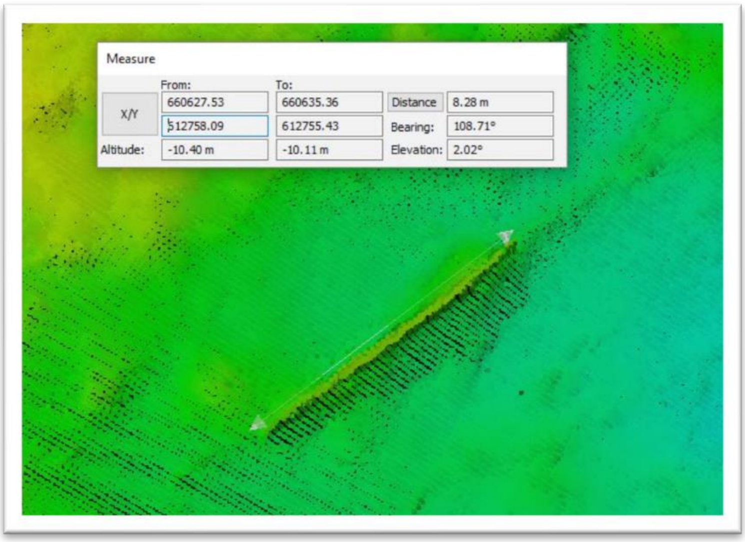
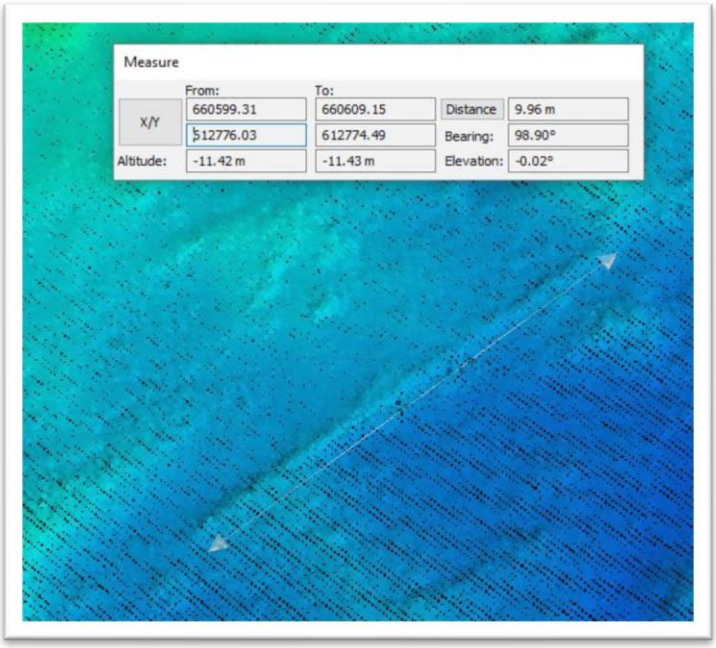


Debris 15

Debris 16



Debris 17



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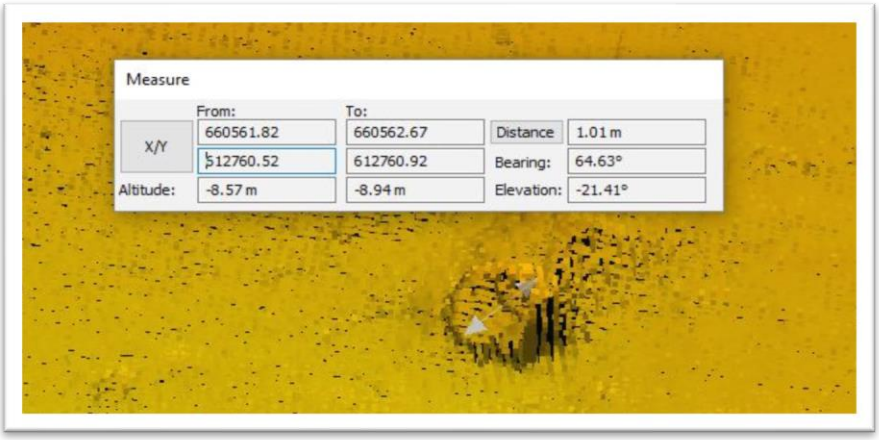
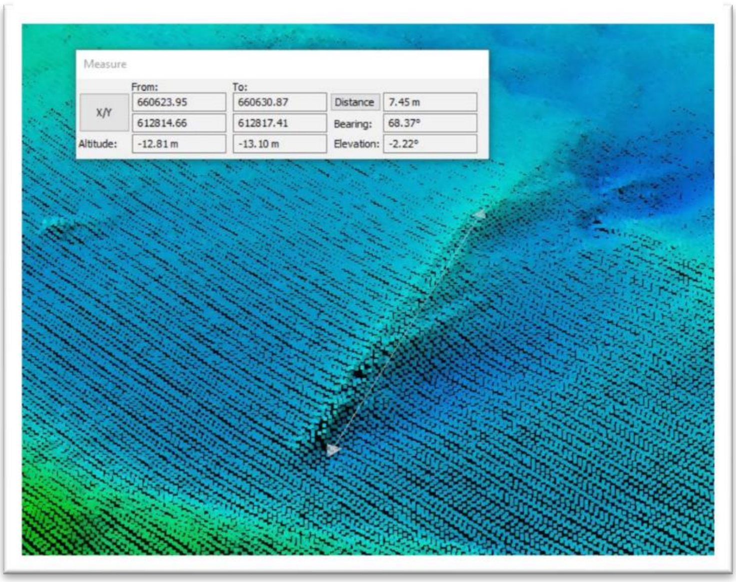
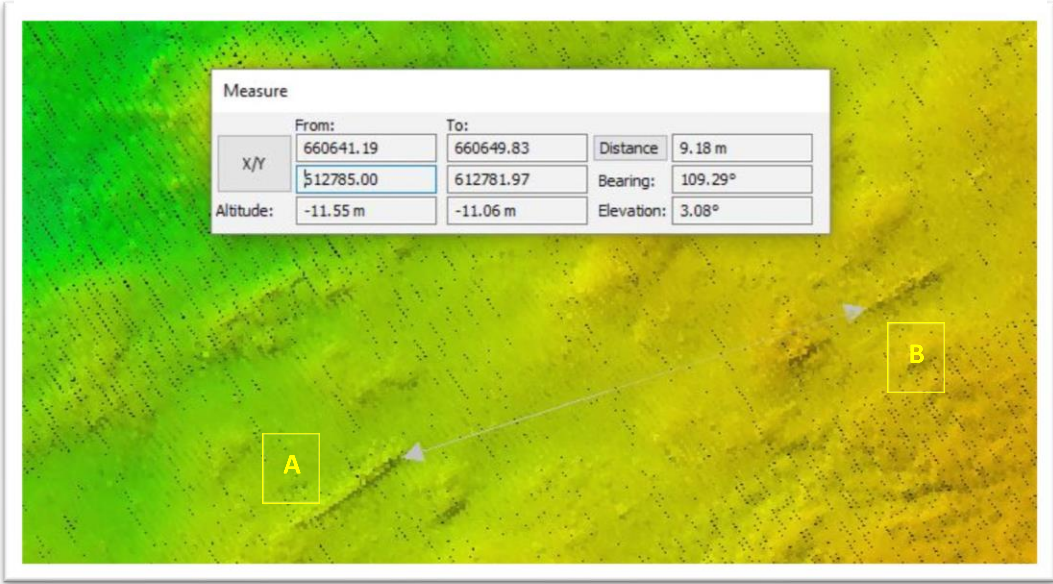


Debris 19



Debris 20 A and B



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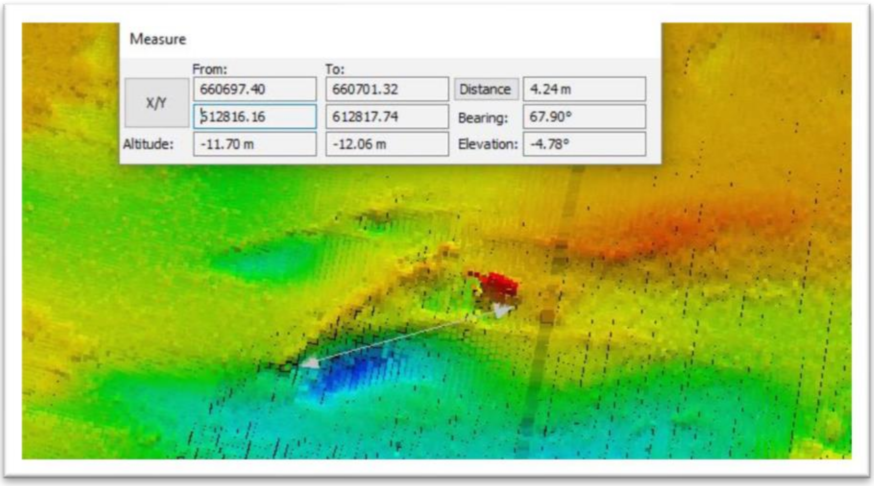
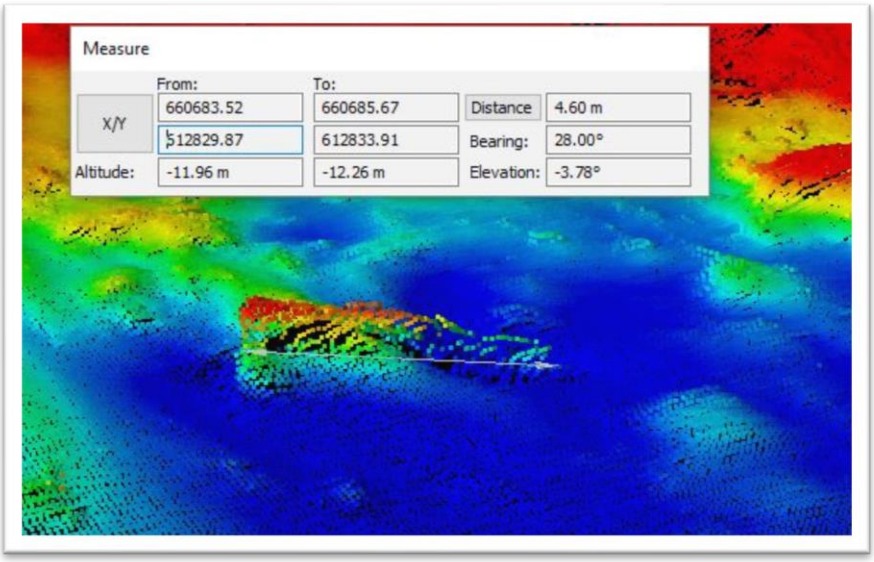
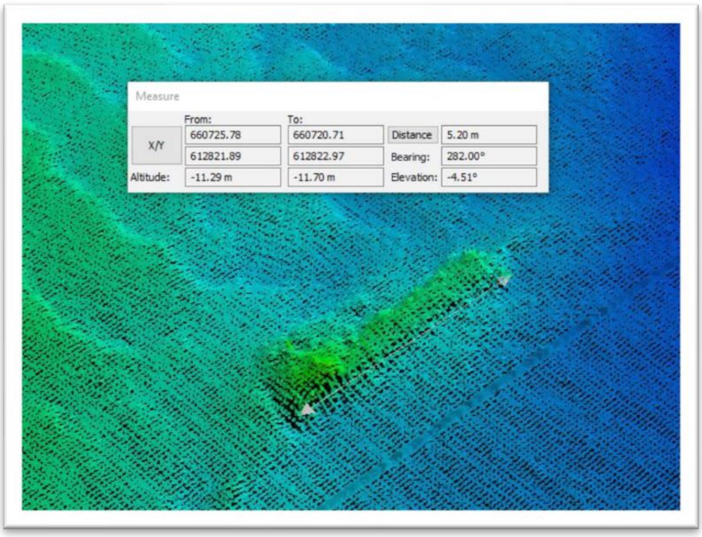


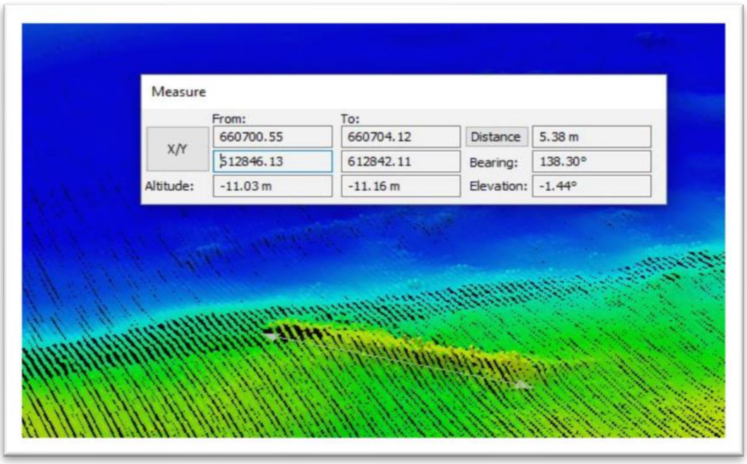
Debris 22



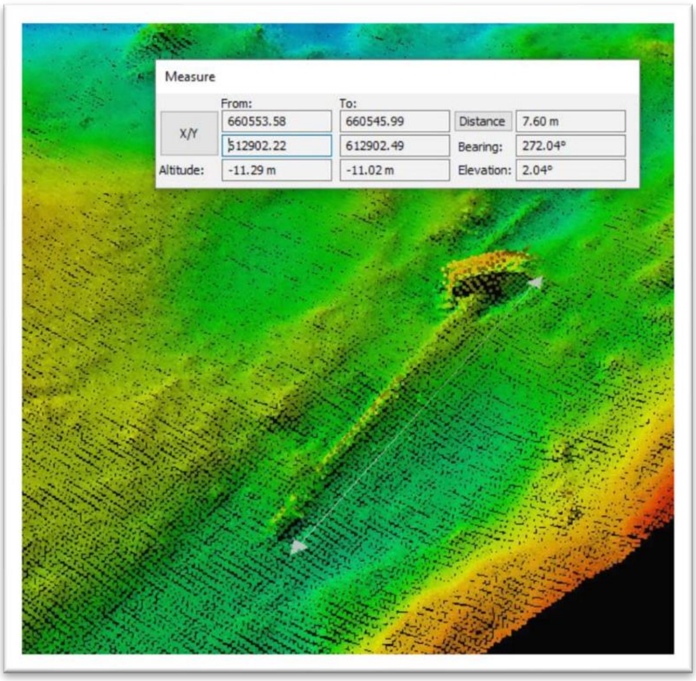
Debris 23



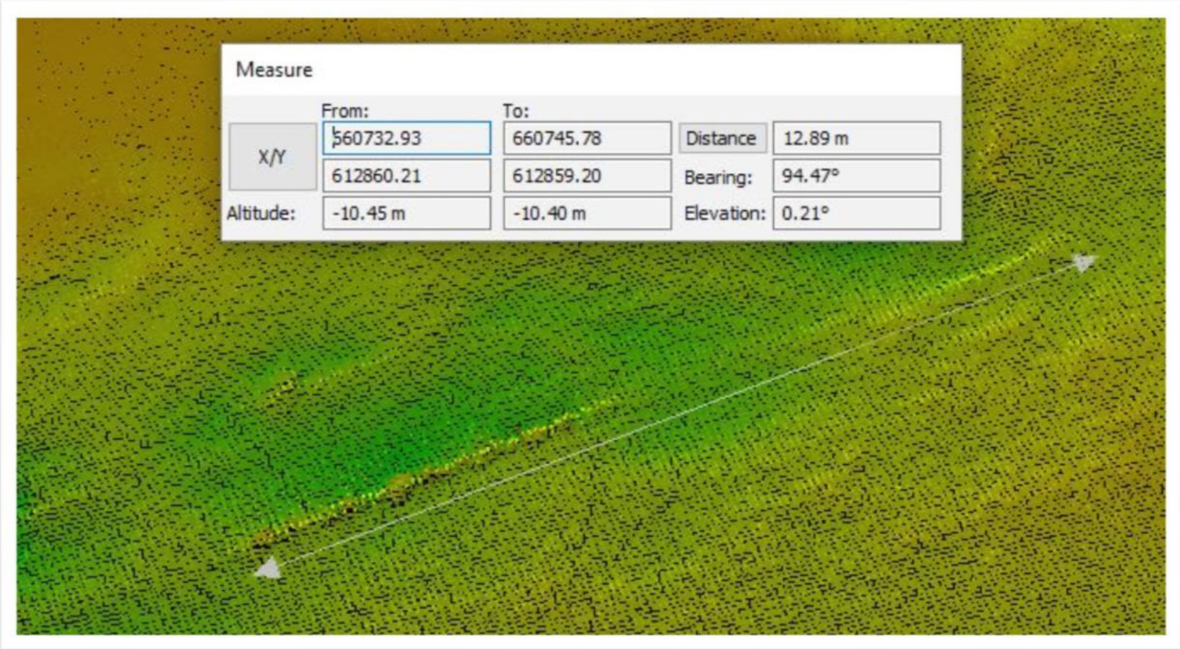
Debris 24



Debris 25



Debris 26


Measure
From:
To:
X/Y
560732.93
660745.78
Distance
12.89 m
612860.21
612859.20
Bearing:
94.47°
Altitude:
-10.45 m
-10.40 m
Elevation:
0.21°

4. Magnetic survey result

4.1 Magnetic targets coordinates

In total, 28 magnetic targets have been detected by the magnetometer, as shown in table 4 and in the chart figure 3.

Table 4: Magnetic targets coordinates (ITM) and Magnitude field values

Target #	Easting	Northing	Magnitude field (nT)	Amplitude (nT)
2	660727.7	612756.5	48685.8	9.3
3	660648.5	612802.3	48667.1	9.6
4	660676.5	612837.2	48543.2	9.7
5	660757.5	612813.1	48650.2	27.9
6	660833.8	612829.1	48406.4	382.5
7	660720.5	612739.0	48661.7	112.9
8	660655.0	612819.3	48649.7	25.8
9	660699.6	612853.0	48203.0	22.2
10	660753.9	612836.4	48499.4	58.4
11	660780.6	612827.9	48538.3	29.4
13	660707.4	612883.2	43155.6	195.9
16	660800.1	612842.1	48072.1	70.8
17	660820.3	612814.3	48612.3	102.0
21	660779.9	612764.6	48716.0	7.1
22	660787.8	612735.8	48676.5	3.9
24	660663.5	612740.7	48526.7	92.7
25	660678.5	612771.2	48678.1	21.8
26	660784.0	612865.0	45951.3	609.5
27	660748.7	612874.8	45042.7	148.2
28	660736.7	612877.6	43406.4	378.5
30	660824.6	612832.6	48248.2	22.1
32	660622.4	612756.7	48451.3	10.6
33	660712.5	612706.8	47954.3	134.4
34	660629.5	612740.3	47956.6	148.3
35	660583.5	612756.4	47871.1	237.0
36	660739.1	612818.4	48648.6	37.9
37	660815.1	612853.9	47193.4	91.8
38	660766.5	612870.0	46452.4	96.3
Coordinates in ITM				

Magnetic targets have been mapped according to their positions and amplitude (nT). The chart in figure 3 below shows the amplitude of each targets.

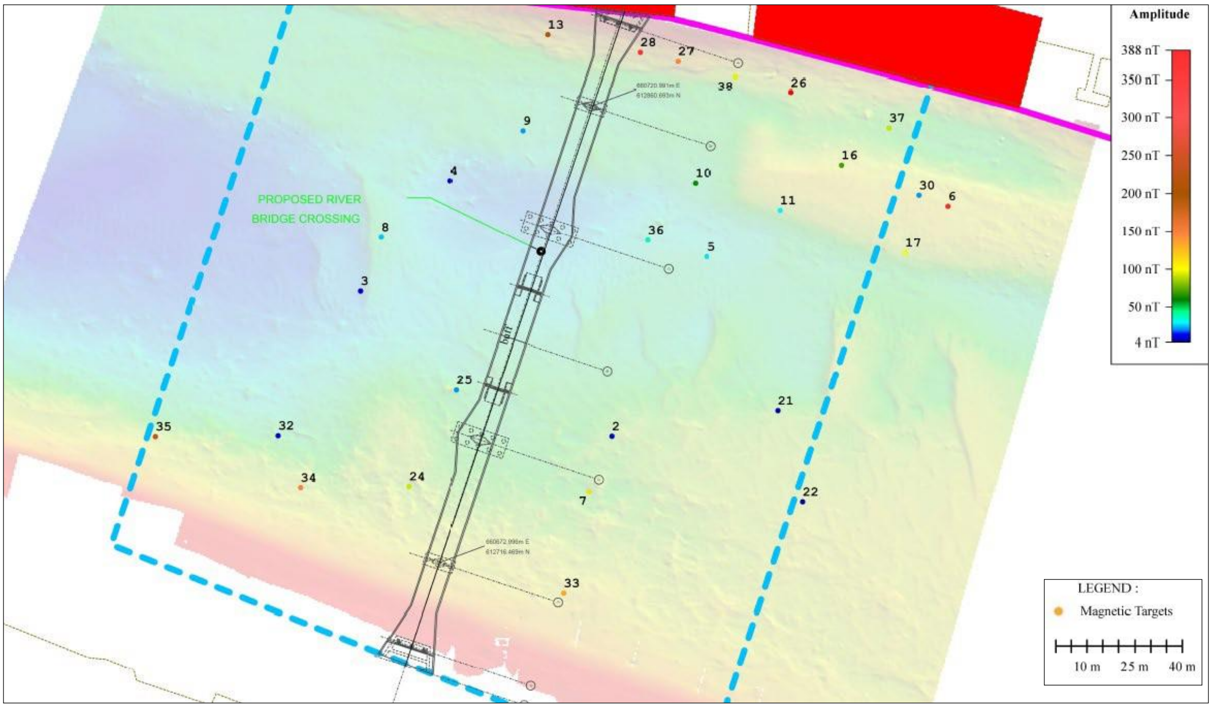
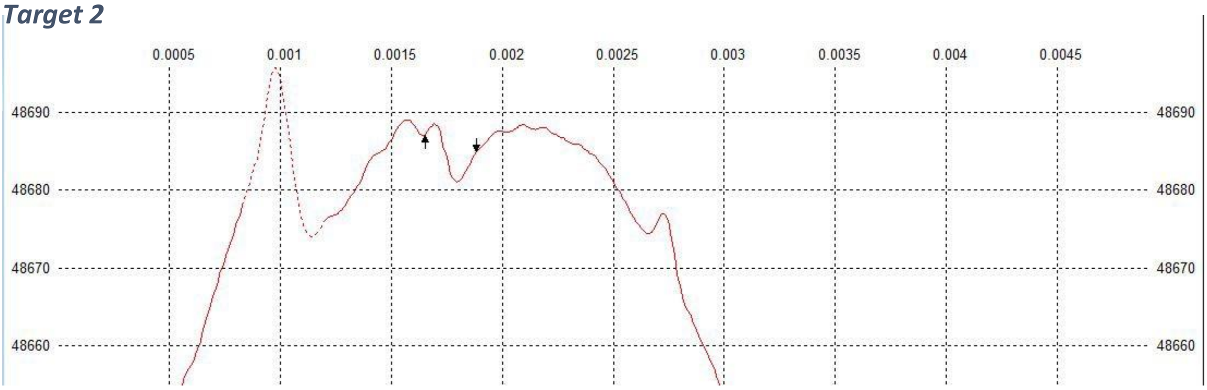


Figure 3: Magnetic targets location by Amplitude (nT)

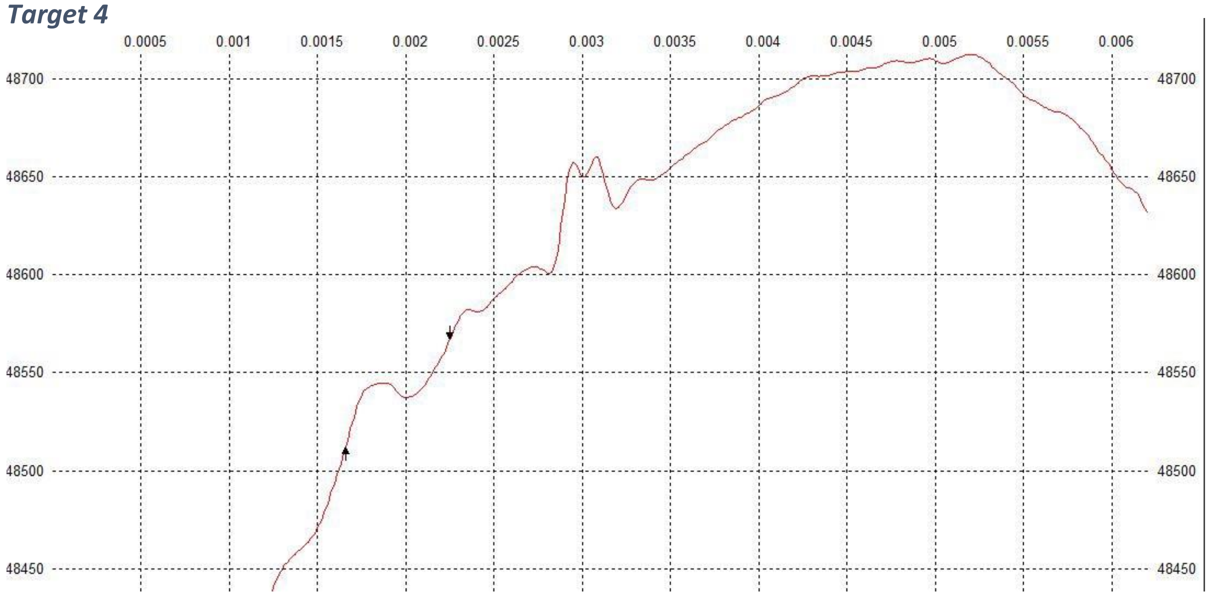
4.2 Magnetic targets data

Target 2

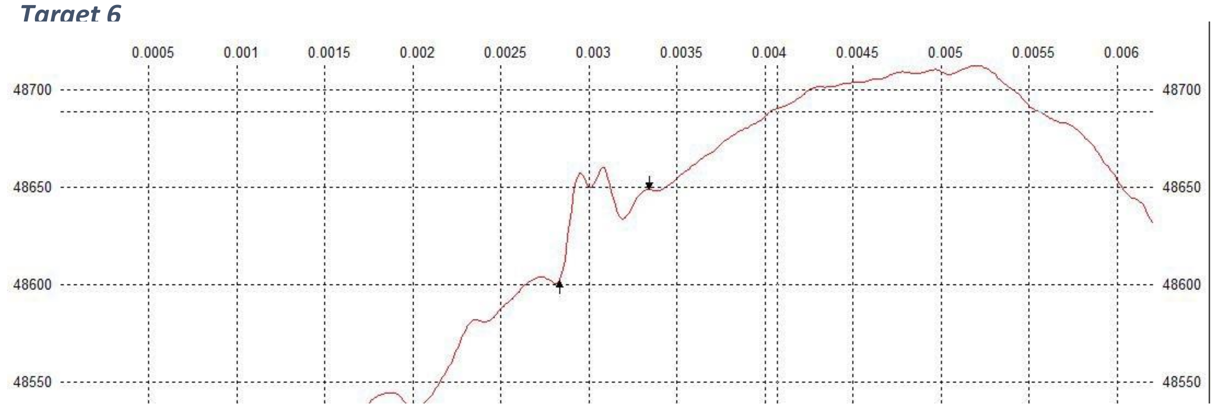


Target 3

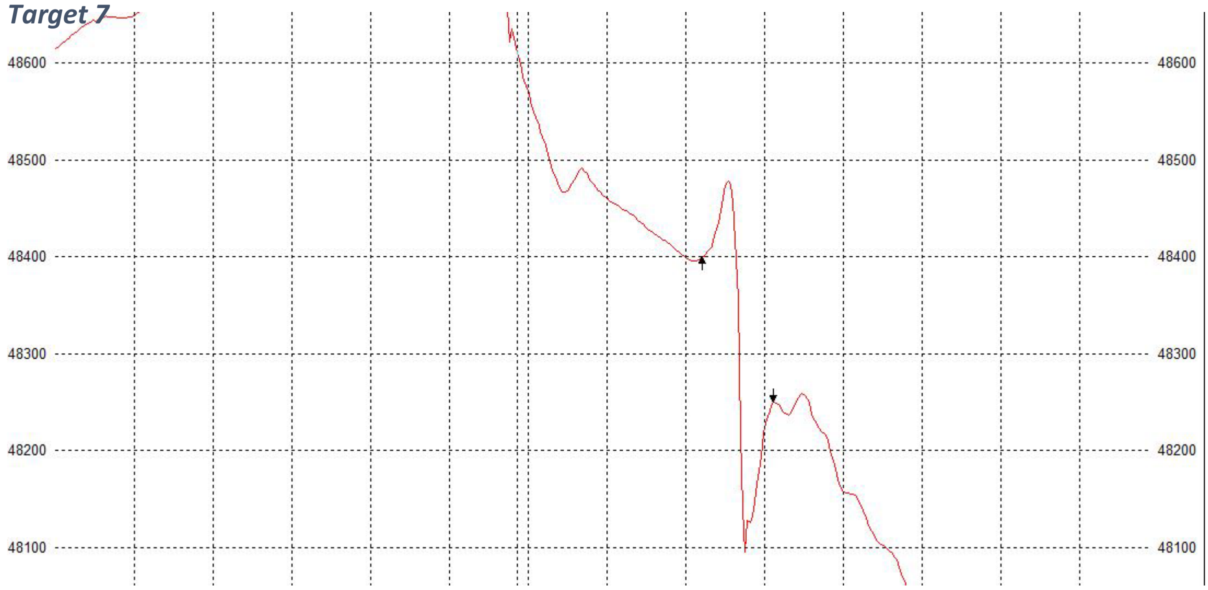
Target 4



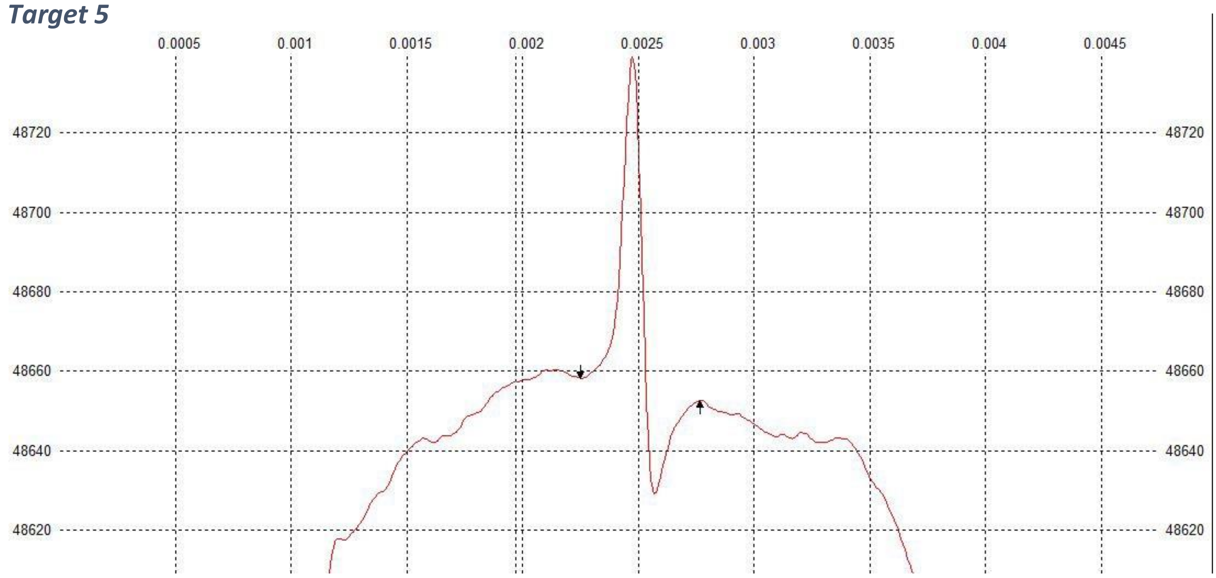
Target 6



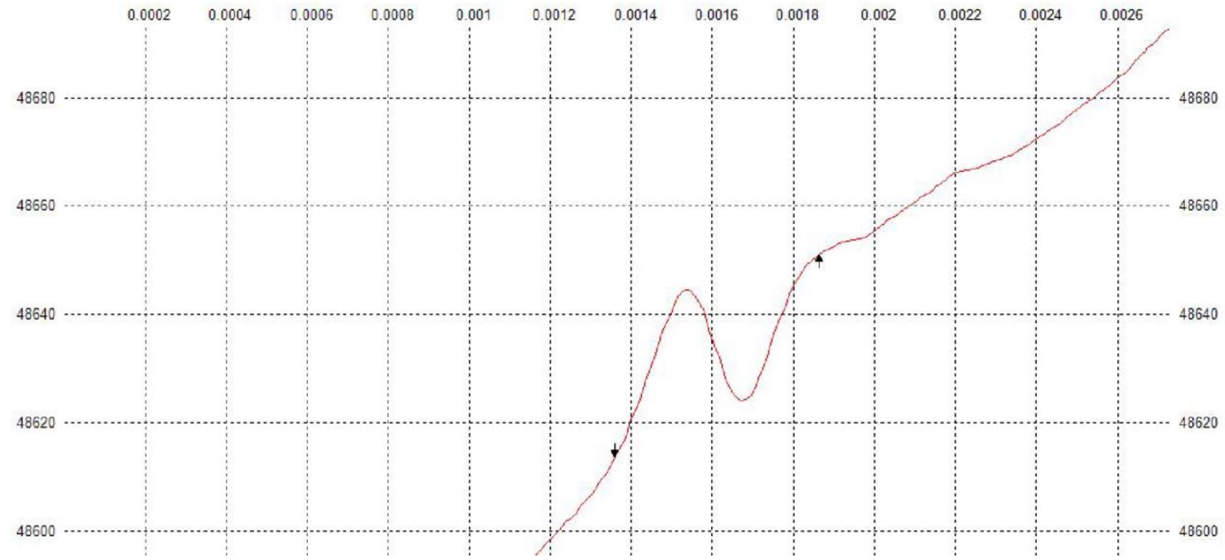
Target 7



Target 5

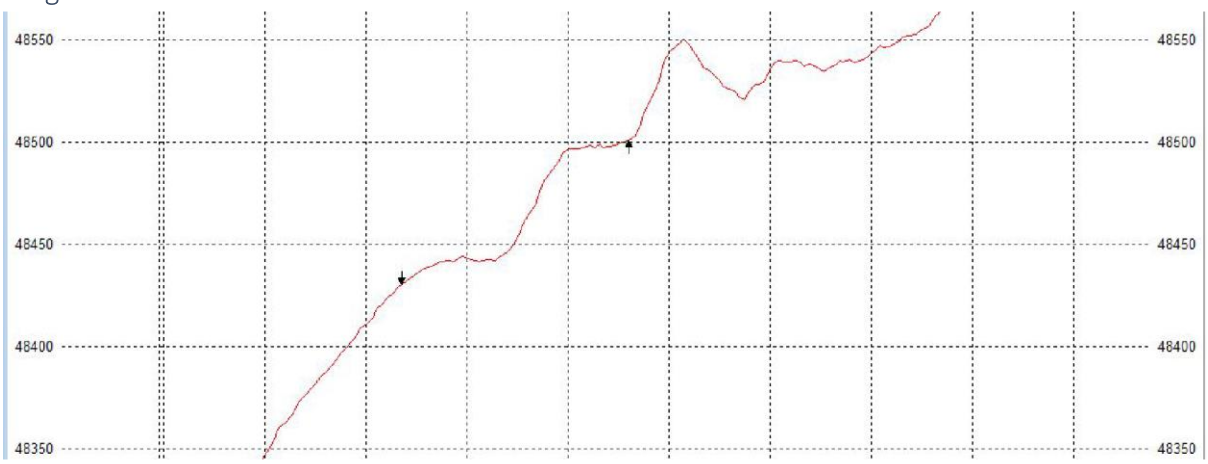


Target 9

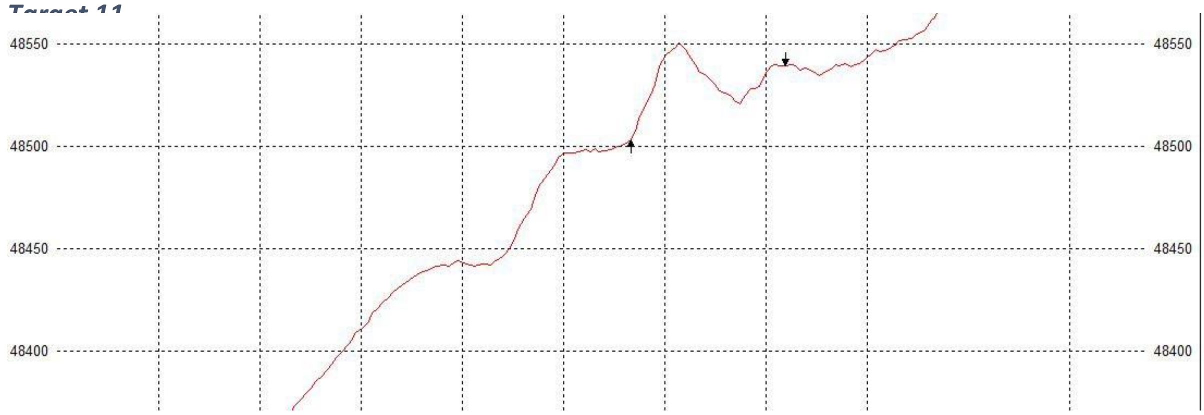


Target 8

Target 10



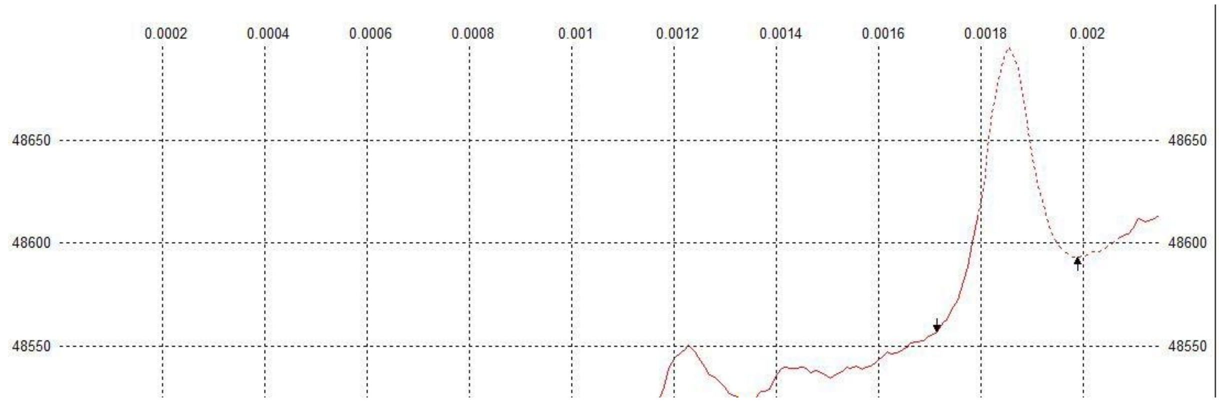
Target 11



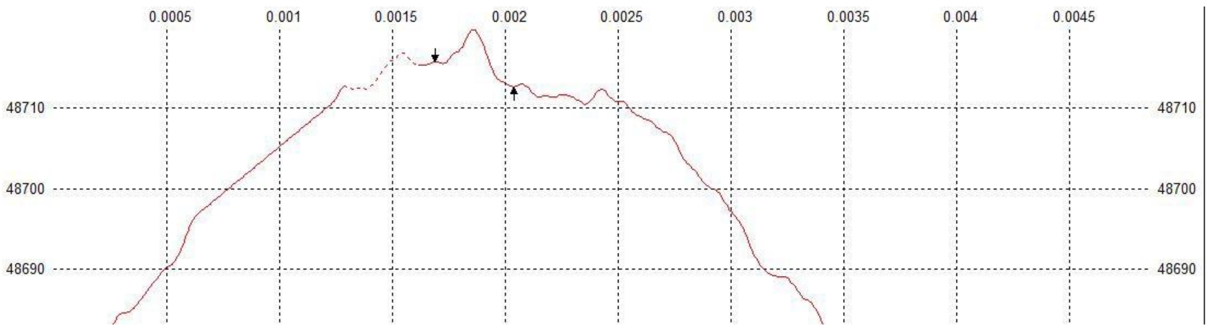
Target 123

Target 13

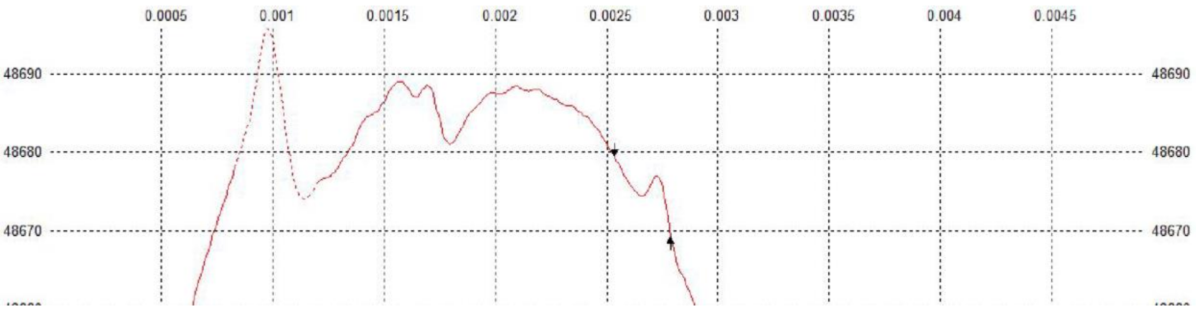
Target 17



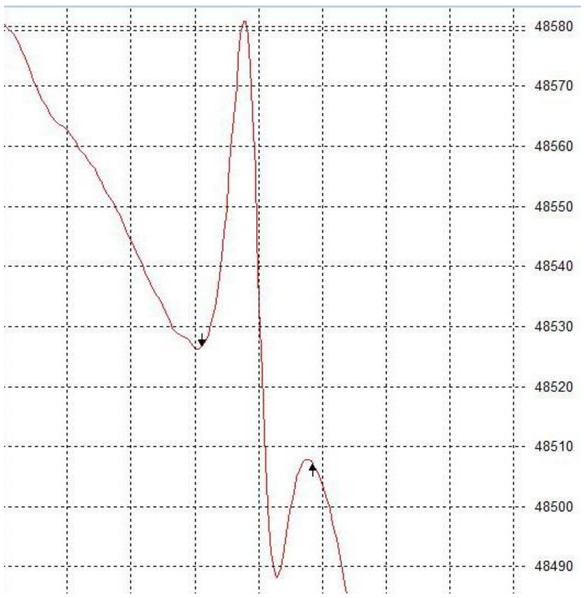
Target 21



Target 22



Target 24



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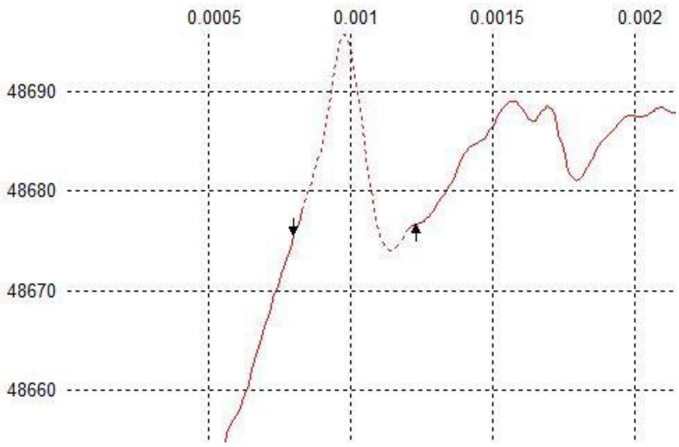

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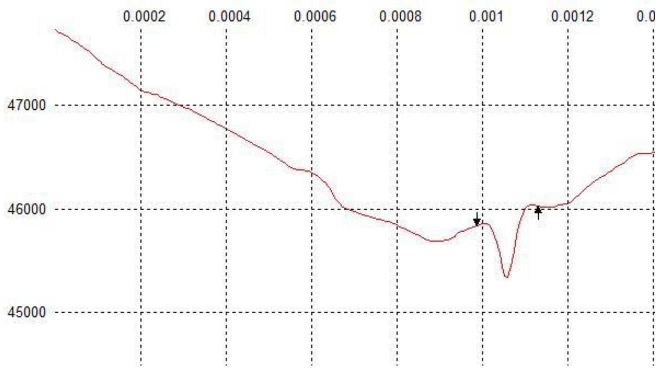

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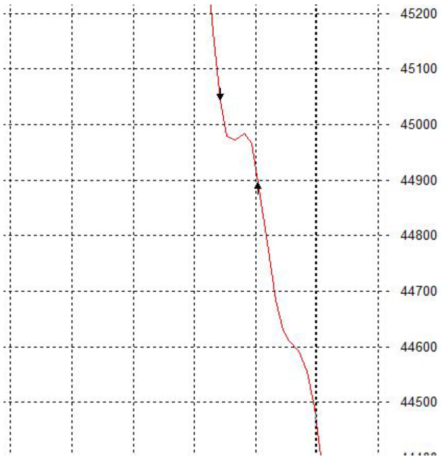
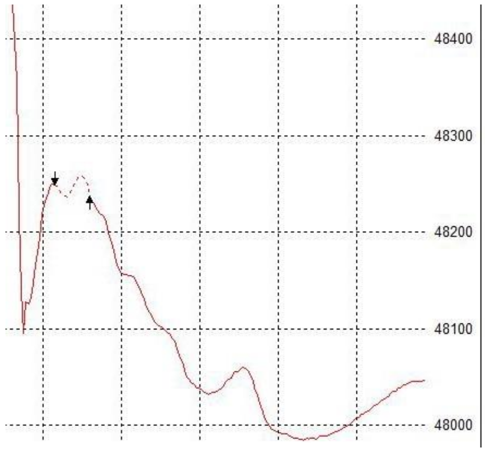
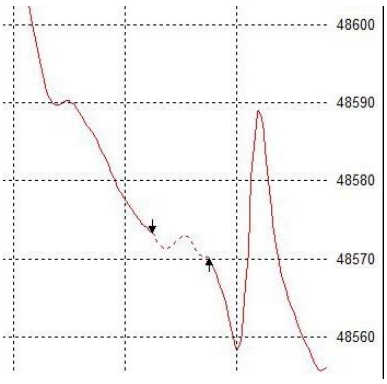


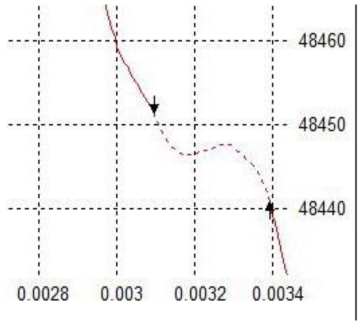
Target 30



Target 31



Target 32



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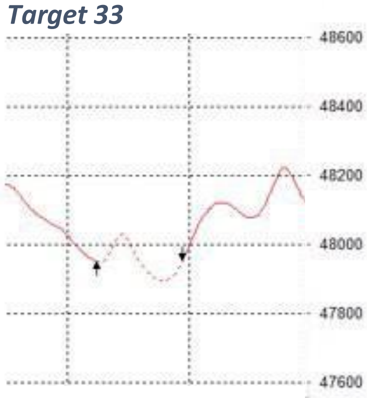

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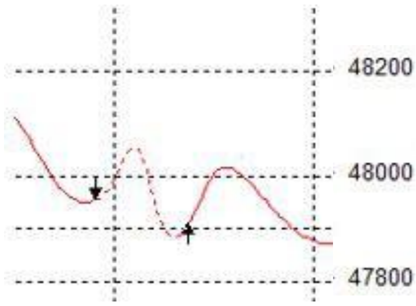
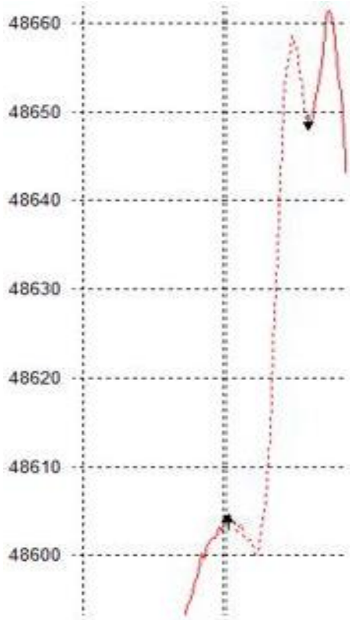
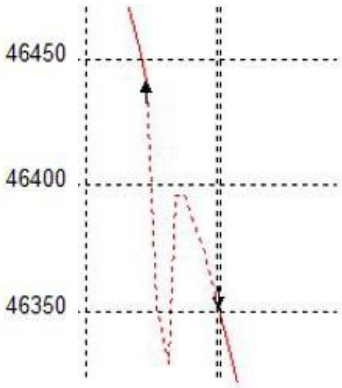


Target 35

Target 36



Target 37



Target 38

The heat map in the figure 4 below, highlight areas of strong change in the magnetic field.

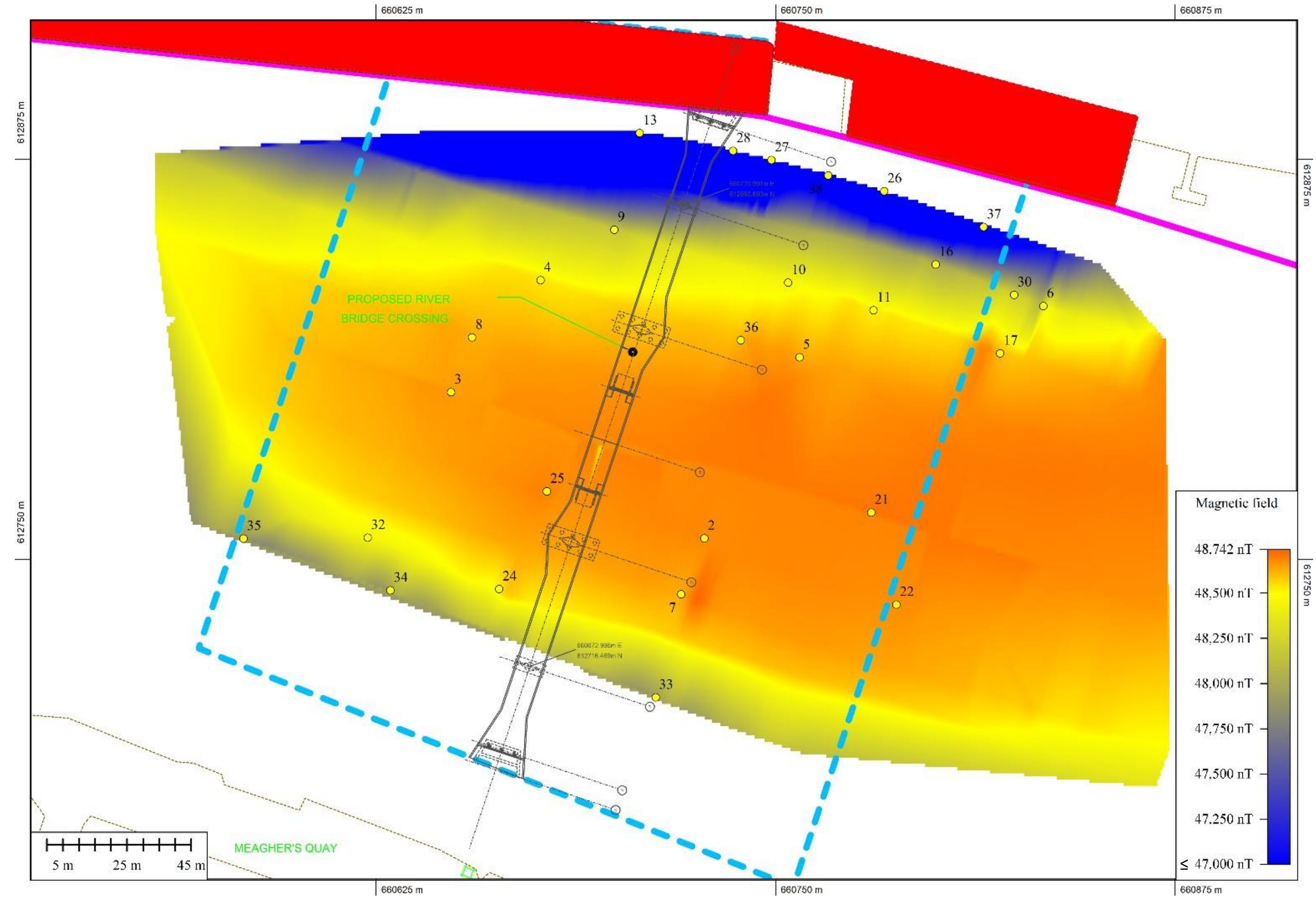


Figure 4: Heat map

5. Acoustic and Magnetic result

The following chart shows the magnetic and acoustic targets, we can see that some of those targets are matching.

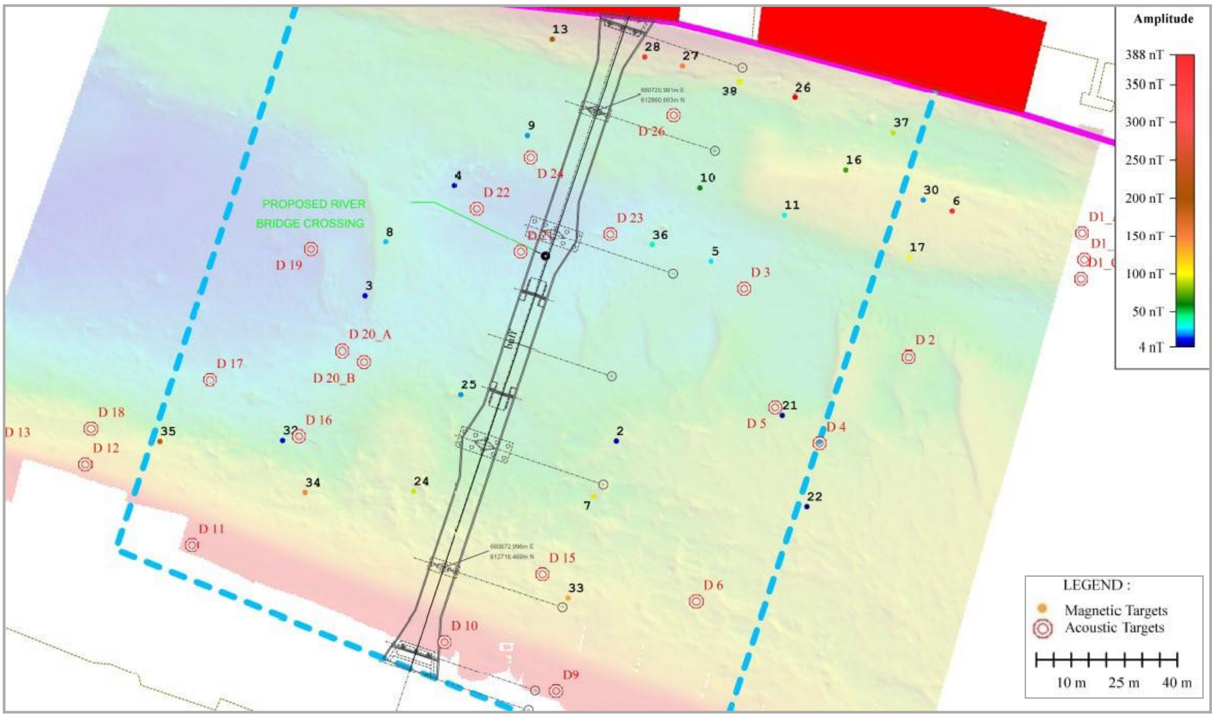


Figure 5: Acoustic and Magnetic targets location

Table 5: Magnetic and acoustic associated targets

Magnetic target #	Acoustic target #	Description
4	D22	NI – long object
9	D24	NI – long object
21	D5	NI – long object
32	D16	NI – long object
33	D15	NI – long object
36	D23	NI – long object

NI= Non Identified

Chapter 15
Architectural Heritage

ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 15 Architectural Heritage

15.1 Introduction

This chapter assesses the potential impact on architectural heritage of the proposed bridge that will cross from Ferrybank, on the northern side of the River Suir, to Meagher's Quay and Coal Quay on the southern side. The history of each side of the river in the vicinity of the proposed bridge is summarised and the historic buildings and other structures in the vicinity are identified and described. Where it is assessed that there could be a significant impact, mitigation measures are suggested.

The proposed bridge will land at Ferrybank, on the northern side of the river, and at the junction of Meagher's Quay and Coal Quay on the southern side. The bridge will have a 32.5m wide central opening with a 25m wide navigable channel, the bascules being supported on either side of the opening by arched cantilevered sections supported on piers. One other pier would stand in the river mid-way between these arched sections and each of the river banks.

15.2 Methodology

The built heritage assessment examines buildings and other structures in the vicinity of the proposed bridge and assesses the architectural significance of those structures with the anticipated effect of the bridge on their character. The emphasis is on structures still standing. Where a building or other structure has been destroyed, it no longer has architectural significance on the landscape, though it may leave traces that fall within the ambit of the archaeological assessment. It may also have had an importance that remains through the historical record, though this is not of concern to the present task. For a structure to have architectural significance it need not survive intact and ruins, or even fragments of buildings, may be of importance.

The identification of buildings and structures to be assessed for impact was based in the first instance on an analysis of current Ordnance Survey maps. The potential for any building or other structure near to the proposed bridge to have special architectural significance was also gauged through examination of the following sources:

- Waterford City Development Plan 2013-2019;
- Pre-Ordnance Survey map by William Richards and Bernard Scalé; and
- Ordnance Survey six-inch maps of 1840 and 1902.

Any buildings close to the proposed bridge that were identified on the earlier Ordnance Survey maps were then checked against the current Ordnance Survey maps to ascertain which were still extant.

The sites on either side of the River Suir were then inspected to identify those structures noted in the desktop survey to assess them for their architectural quality. The possibility of finding structures of architectural significance not identified from the desktop assessment was kept in mind during the site work and any potential additional structures were examined.

The entries in the Record of Protected Structures (RPS) for the city of Waterford were also checked.

The structures identified in the vicinity of the proposed bridge were examined to assess the potential effects of the proposal and to consider potential for mitigation where necessary. In each case the structures identified are rated in accordance with the system adopted by the National Inventory of Architectural Heritage (NIAH) wherein a structure is rated as being of International, National, Regional or Local interest, or, if a structure is of no special interest, the NIAH includes a category of "Record only"[1].

The definitions for each of these categories is as follows:

International:

Structures or sites of sufficient architectural heritage importance to be considered in an international context. Examples include St Fin Barre's Cathedral, Cork. These are exceptional structures that can be compared to and contrasted with the finest architectural heritage in other countries.

National:

Structures or sites that make a significant contribution to the architectural heritage of Ireland. These are structures and sites that are considered to be of great architectural heritage significance in an Irish context. Examples include Ardnacrusha Power Station, Co. Clare; the Ford Factory, Cork; Carroll's Factory, Dundalk; Lismore Castle, Co. Waterford; Sligo Courthouse, Sligo; and Emo Court, Co. Laois.

Regional:

Structures or sites that make a significant contribution to the architectural heritage within their region or area. They also stand in comparison with similar structures or sites in other regions or areas within Ireland. Examples would include many Georgian terraces; Nenagh Courthouse, Co. Tipperary; or the Bailey Lighthouse, Howth. Increasingly, structures that need to be protected include structures or sites that make a significant contribution to the architectural heritage within their own locality. Examples of these would include modest terraces and timber shopfronts.

Local:

These are structures or sites of some vintage that make a contribution to the architectural heritage but may not merit being placed in the RPS separately. Such structures may have lost much of their original fabric.

Record only:

These are structures or sites that are not deemed to have sufficient presence or inherent architectural or other importance at the time of recording to warrant a higher rating. It is acknowledged, however, that they might be considered further at a future time.

The legislation relating to the protection of architectural heritage is set down in the Planning and Development Act 2000 and this defines architectural heritage as including structures which are of special interest under the headings of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. Wherever the phrase "special architectural interest" is used in this report it should be taken as including special interest in any one or more of these eight categories.

In this assessment, each building or structure that is considered is assigned a rating in accordance with the NIAH system, or is stated to be not of special architectural interest. Where the rating is deemed to be higher than "Record only", the category of special interest is noted.

It should be noted that the term "special architectural interest" applies only in the context of this assessment of architectural heritage and does not imply that those

[1] National Inventory of Architectural Heritage *NIAH Handbook* edition June 2006 pp. 22-23

buildings and other structures that are not considered to be of special architectural interest are in any way inferior or are of lower value.

15.3 Description of Receiving Environment

15.3.1 Historical background

The city of Waterford has its origins in Viking times, when the city stretched along the waterfront between Barronstrand Street and The Mall. Following the arrival of the Normans the city expanded westwards, presenting a longer frontage to the river. By the mid-eighteenth century the quays stretched along the full length of the city's river frontage, from Reginald's Tower and The Mall in the east, to the Graving Bank in the west, around the site of the present Grattan Quay.

Plate 15.1 Detail of Van der Hagen's painting of Waterford, 1736

The quay frontage of the city at this time was recorded in an oil painting by William van der Hagen, taken from Misery Hill, in 1736. In the detail presented in Plate 15.1 Barronstrand Street is in the centre of the view. Directly opposite Barronstrand Street a small building may be seen on the quays at right angles to the river. Ships may be seen with their sterns projecting out into the river.

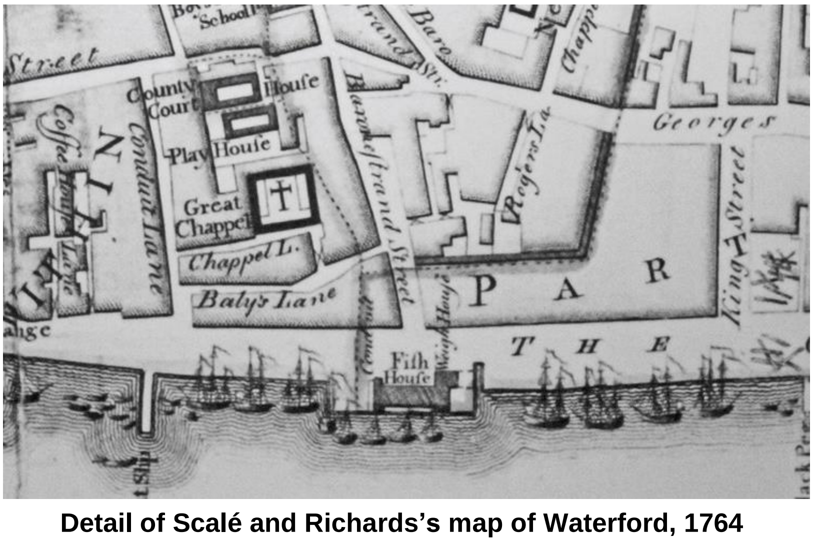


Plate 15.2 Detail of Scalé and Richards's map of Waterford, 1764

The city was recorded in map form in the mid-eighteenth century by Bernard Scalé and William Richards, who showed a more substantial building on the frontage opposite Barronstrand Street and this was labelled "Fish House", see Plate 15.2. The quay projected into the river at this point. The Fish House shown on the map had been built shortly after van der Hagen had executed his painting and, presumably, replaced the smaller structure on or near the site. Charles Smith described it thus, in 1746 (with spelling modernised):

The fish house, conveniently situated on the quay, is a neat, plain building, supported by several arches of hewn stone, and within, are blocks of stone tables for the laying on of the fish, which are kept constantly clean and sweet. Over the house is a neat lantern, with a bell, which is tolled to warn the inhabitants when the fish is arrived. This house was but lately erected at a considerable expense.

Smith described the quay as being above half a mile in length and of considerable breadth – it is approximately a kilometre long. He stated that the quay was fronted with hewn stone, well paved, and in some places was 40 foot broad – equivalent to about 12 metres. About five moles or piers projected from the quay into the river. One of these – the Ferry Boat Slip – may be seen towards the left in the map extract above. The detail of the Scalé and Richards map of 1764 that is presented in Plate 15.3 shows both sides of the river. The site of the proposed bridge is in the centre of this map extract, which shows that on the northern bank, at the bottom of the map extract, there are fields and no buildings in the proposed location for the bridge. The ferry that gave the name to Ferrybank is seen a little to the left.

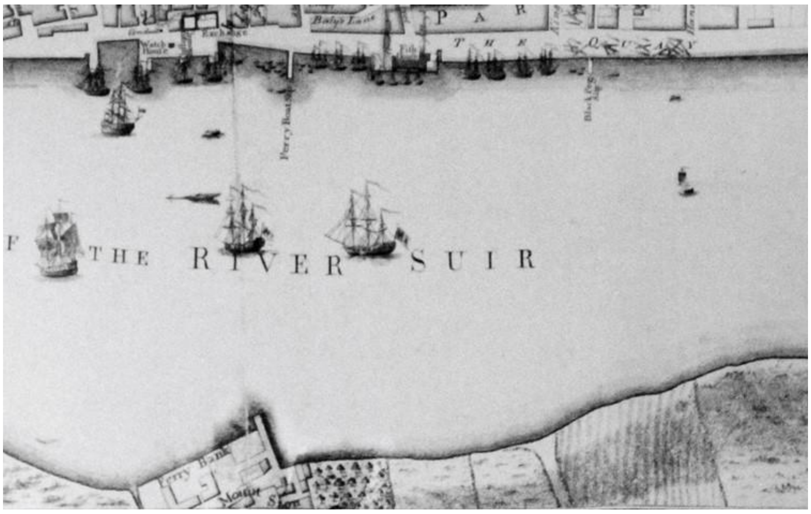


Plate 15.3 Detail of Scalé and Richards's map of 1764 showing Ferrybank at the bottom

In 1784 an act of parliament gave the Corporation of Waterford the power to bring into being commissioners with responsibility for making wide and convenient streets in the city. The powers given to the commissioners under the terms of the act of parliament were the same as those under which the equivalent commissioners in Dublin operated, with powers of compulsory purchase and with compensation to be determined by an independent jury. Over the ensuing decades, the commissioners brought about many changes to the city, including the widening of the quays. By the time of the publication of the first Ordnance Survey map of Waterford in 1840, the quay at the end of Barronstrand Street was more than 30m wide, between the facades of the buildings and the water's edge, as compared to the figure of 12m suggested by Smith a century before. Subsequent widening in the later 20th century has brought the width to about 55 metres.

Up to the end of the 18th century, the ferry was extremely important to Waterford as there was no bridge over the River Suir. The lowest bridging point on the river was in Carrick-on-Suir, some 30km upstream. The width of the river was a major problem for the construction of a bridge – some 300m at the ferry crossing. Furthermore, the river was up to eighteen metres deep. Various proposals for bridging the River Suir at Waterford came to nothing.

In 1789 the Corporation of Londonderry engaged an American, Lemuel Cox, to bridge the Foyle, which was also about 300m wide. Cox specialised in the construction of timber bridges of significant length and while he was in Ireland, he built long bridges at Wexford, Ferrycarrig, New Ross and Mountgarret (near New Ross). In 1793 he was engaged to bridge the River Suir at Waterford and he selected a site at the western end of the city, where the river was only about 250m wide. His timber trestle bridge was completed in January 1794 as presented in Plate 15.4 and survived more than a century until it was replaced by a ferro-concrete bridge in 1910. This, in turn, was replaced by the present bridge, Rice Bridge.

Plate 15.4 Cox's timber bridge of 1794

In the 1820s the Fish House was removed from the quay opposite Barronstrand Street. In 1824 Rev. Ryland commented that the market house "has recently been erected on a piece of ground immediately adjoining the river; … but its situation is ill chosen, as it breaks in upon the line of quay, which extends from one end of the city to the other …" He added that "the Fish House, a neat building, is similarly situated, and obstructs the view in like manner. It is to be hoped that these two buildings may be made to give way to the beauty of the city." He got his wish as far as the Fish House was concerned, as it is not depicted on Leahy's map, published in 1834. The market building lasted longer and is seen in Plate 15.4.

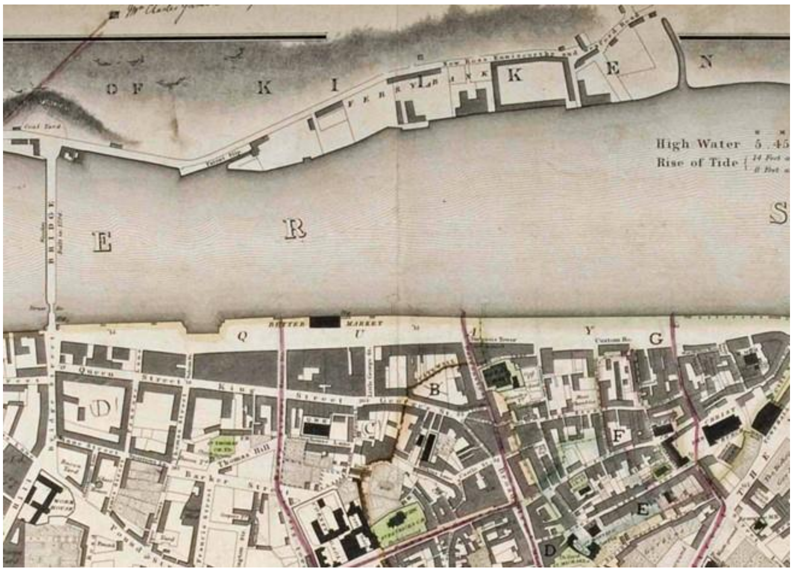


Plate 15.5 Detail of Leahy's map of Waterford, 1834

Leahy's map appears to show the quays to be somewhat wider than they had been in the 18th century, indicating that the Wide Streets Commissioners had completed their work on the river front, see Plate 15.5. The site for the proposed bridge on the quays is indicated by the purple line crossing the quays near the centre of the map. On the northern side of the river the map shows that there were now buildings alongside the road and near the river front close to the location for the proposed bridge.

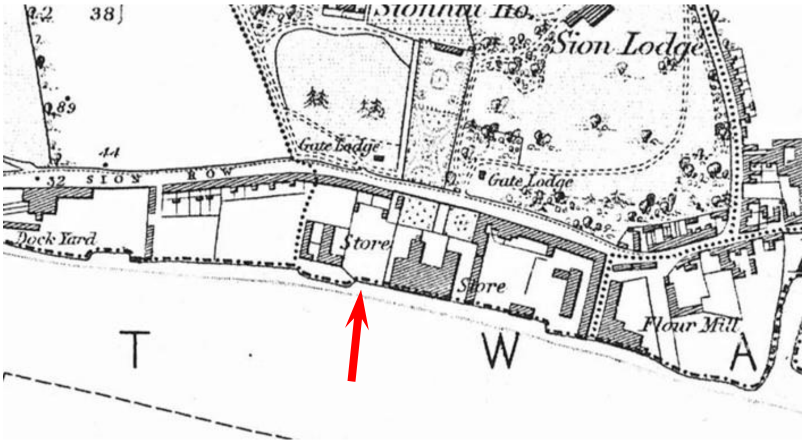


Plate 15.6 Ordnance Survey map of c.1840 showing Ferrybank

The first edition Ordnance Survey map that was published in 1842 showed the buildings on the Ferrybank side in more detail than Leahy's map, see Plate 15.6. This shows that there were storage buildings related to the port on the north bank of the river, with houses along most of the southern side of the road. The arrow on the map in Plate 15.6 indicates the approximate position of the proposed bridge.

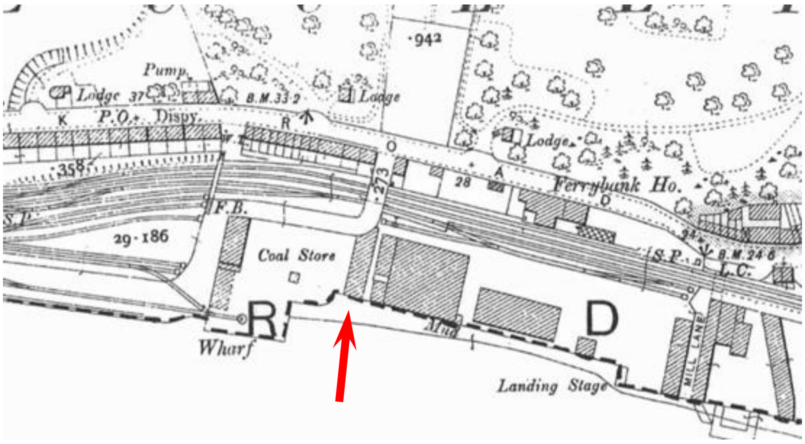


Plate 15.7 Ordnance Survey map of c.1903 showing Ferrybank

By the opening years of the 20th century, the buildings along the northern bank of the River Suir had changed slightly, with a building now on the site proposed for the bridge, see Plate 15.7. The most significant change in this area was the arrival of the railway. Waterford had received its first railway connection in 1854 with the opening of a line to Kilkenny by the Waterford and Kilkenny Railway Company and another to Limerick by the Waterford and Limerick Railway Company. These lines terminated to the west of Waterford Bridge and the station on the present site opened in 1864. A siding was constructed to Ferrybank in 1883 to serve Hall's Flour Mills and in 1904 the main line was continued through Ferrybank and onward to New Ross, while a second line opened to Rosslare in 1906. The bridge over the railway at Ferrybank would have been built in about 1903 as part of these railway works.

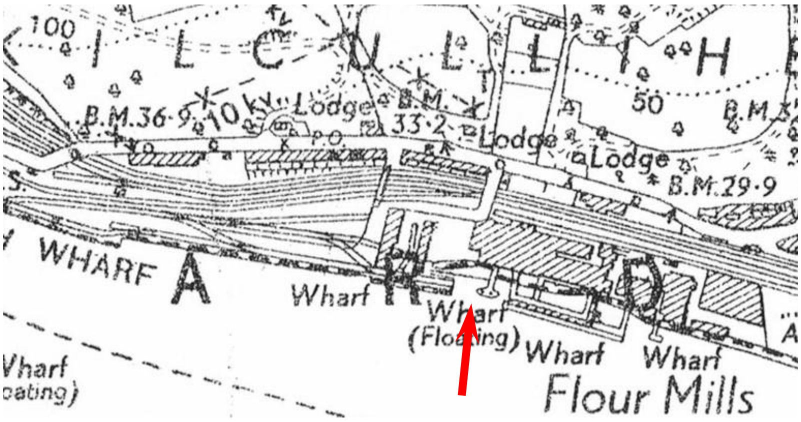


Plate 15.8 Ordnance Survey map of 1950

The amount of development at Ferrybank in the vicinity of the proposed bridge changed little over the subsequent decades of the 20th century and the Ordnance Survey six-inch map of 1950, presented in Plate 15.8, shows similar railway sidings and port buildings.

Plate 15.9 Ordnance Survey map of c.1840 showing southern side of river

On the southern side of the river the Ordnance Survey map that was published in 1842 confirms that the Fish House had gone from the quays at that time. The map shows that this part of the quays was open, without buildings, as presented in Plate 15.9.

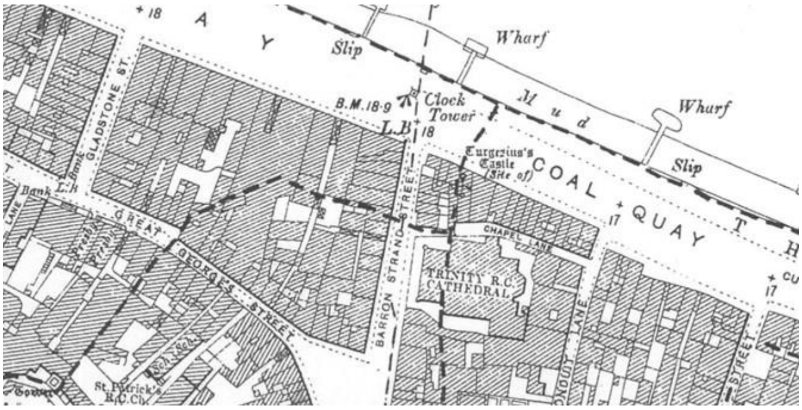


Plate 15.10 Ordnance Survey map of c.1903 showing southern side of river

The Ordnance Survey's map that was published in the opening years of the 20th century show that by that time pontoons, or floating wharves, had been provided in the river to allow for larger ships to berth alongside the quays. The map also shows the Clock Tower, as presented in Plate 15.10. This clock tower was built to the design of Charles Tarrant, Waterford County Surveyor, and completed in 1861 with funds by public subscription.

During the 20th century this part of the quays remained relatively unchanged until the end of the century, when the pontoons were removed from the river and the quay was widened. Subsequently a significant amount of street furniture has been provided along the quays, providing for car parking, cycle parking, tourist information and other facilities.

15.3.2 Conservation Context

15.3.2.1 Protected structures

The Record of Protected Structures (RPS) for Waterford City is set down in the Waterford City Development Plan 2013-2019 as amended in February 2018. The prefix WA730 was added to each of the reference numbers at this time of this amendment. The Record of Protected Structures includes a number of buildings fronting on to Meaghers Quay and Coal Quay, in the vicinity of the proposed bridge.

These are listed in Table 15.1. Buildings in other streets in the vicinity, such as Barronstrand Street, are too far from the proposed bridge for it to have any appreciable impact on their character.

Table 15.1 Record of Protected Structures in the Vicinity of the Proposed Bridge

Reference	Address	Description
WA730 384	73-74 Coal Quay	Allied Irish Bank
WA730 997	75 Coal Quay	Kelly's
WA730 998	76 Coal Quay	Kelly's
WA730 996	81 Coal Quay	The Quay
WA730 700	82 Coal Quay	Clock Tower Dry Cleaners
WA730 702	83 Coal Quay	Farrell Travel
WA730 699	84 Coal Quay	Grant Hair
WA730 385	85 Coal Quay	-
WA730 573	86 Coal Quay	-
WA730 386	87 Coal Quay	-
WA730 387	88 Coal Quay	-
WA730 574	89 Coal Quay	-
WA730 388	90 Coal Quay	Including medieval chamber at rear
WA730 575	90-91 Coal Quay	-
WA730 576	92 Coal Quay	-
WA730 577	95 Coal Quay	-
WA730 389	97 Coal Quay	Including 16th century f/place window niche
WA730 392	Meagher's Quay	Clock Tower
WA730 393	50 Meagher's Quay	-
WA730 394	60 Meagher's Quay	-
WA730 833	67 Meagher's Quay	Kitchen Shop (The)
WA730 507	14 Dock Road	-
WA730 594	Meagher's Quay	Cast iron bollards from 1899 and 1900

15.3.2.2 Conservation areas

The site for the proposed bridge on the southern side of the river is within the South Quays Architectural Conservation Area (ACA). The ACA includes the quays from the margin of the river to the rear boundaries of the buildings fronting on to the quay. There is no conservation area at Ferrybank, where the northern end of the proposed bridge will land.

15.3.2.3 National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) includes a number of buildings along the quays in Waterford and others at Ferrybank. This includes many of the protected structures listed in Table 15.1 along with those listed in Table 15.2.

Table 15.2 Buildings Listed by the National Inventory of Architectural Heritage

Address	Description
52-53 Meagher's Quay	Shaw and Sons
61-66 Meagher's Quay	Granville Hotel
79 Coal Quay	Top to Toe
80 Coal Quay	Shoe Box
North Wharf	Freestanding steel crane
Dock Road	R & H Hall grain store
Edmund Rice Bridge	Concrete road bridge

15.3.3 Site Survey

15.3.3.1 Access at Ferrybank

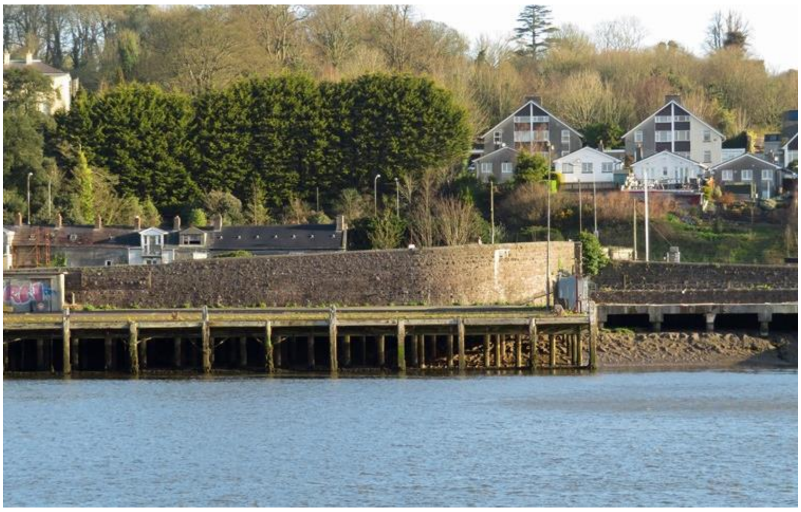


Plate 15.11: Site for bridge landing at Ferrybank

On the northern side of the river the bridge will land at Ferrybank. Here the existing wharfs alongside the river are built out over the river on piles, the deck and the piles being of concrete, with timber fenders along the river margin. Access to this area is via a bridge over the railway and a ramp running down to the wharf, flanked by stone walls. The bridge has abutments of stone, while the deck is of reinforced concrete. This access is a protected structure and is included in the Record of Protected Structures under reference 529.

Date of construction: c.1900

Protected structure?: Access was a protected structure, reference 529, however it has now been removed from the Record of Protected Structures

Special interest: Technical, historical

Special interest rating: Regional

Impacts on built heritage: Pedestrian access to the proposed bridge will be via the access over the railway. This will necessitate breaking open a pedestrian access through the parapet wall that encloses the ramp, where it turns from the bridge to descend to the wharf.

Level of impact: Moderate

Effects on setting:	Slight
Mitigation required:	Yes. Stones salvaged in the works will be used at either side of the breach in the wall and laid in a lime-based mortar to match the stonework of the original wall.
Residual impact:	Slight

15.3.3.2 Number 14 Dock Road

Plate 15.12 Number 14 Dock Road

Number 14 Dock Road stands adjacent to the access down to the North Wharf at Ferrybank. The house dates from around the 1830s and has a panelled front door with segmental fanlight. There is only one window in the northern elevation, while the rear, south-facing, elevation is two-storey and has a number of windows on each level looking southward. The house is separated from the access ramp to the wharf by the railway line and the garden at the rear of the house.

Date of construction:	c.1830s
Protected structure?:	Yes, reference 507, doorway only
Special interest:	Architectural
Special interest rating:	Regional
Impacts on built heritage:	The nearest point of the proposed bridge will be approximately 90m from the house, with the access ramp lying between. The access to the bridge from the ramp will be about 35m from the house, on the opposite side from the doorway.
Level of impact:	None
Effects on setting:	None
Mitigation required:	No

15.3.3.3 Clock Tower

Plate 15.13 Clock tower

The Clock Tower stands opposite Barronstrand Street at the intersection between Meagher's Quay and Coal Quay. It was built in 1861 and has been a prominent landmark on the quays ever since. The tower stands approximately 30 metres from the present river margin of the quays.

Date of construction:	1905-06
Protected structure?:	Yes, reference 392
Special interest:	Architectural, artistic, historical, social, technical
Special interest rating:	Regional
Impacts on built heritage:	There will be no direct impact. The bridge will land at the quay edge about 30m away, arriving at a height of approximately 1.5m above the deck of the quay so as to avoid a breach in the flood defences. The ground will be ramped up from the base of the Clock Tower to the bridge deck. The tower will be protected during the works.
Level of impact:	No direct impact
Effects on setting:	Insignificant. The proposed bridge will provide a good vantage point from which to view the Clock Tower.
Mitigation required:	No

15.3.3.4 Coal Quay

Plate 15.14 Coal Quay, in the vicinity of the proposed bridge

Coal Quay lies to the east of the junction of Barronstrand Street and the South Quay and to the east of the proposed landing of the southern end of the bridge. A significant proportion of the buildings fronting Coal Quay are protected structures, including the three that will be closest to the proposed bridge – these are the two cream-coloured buildings in the centre of the photograph and the stone-faced bank building at the right-hand margin, i.e. 73-76 Coal Quay. These protected structures are presented in Table 15.1 and their RPS reference numbers are 384, 997 and 998. Coal Quay is also within the South Quays Architectural Conservation Area.

Date of construction:	Varied
Protected structure?:	There are 17 protected structures in Coal Quay
Special interest:	Architectural
Special interest rating:	Regional
Impacts on built heritage:	There will be no direct impact. The proposed bridge will land on the southern quays at a minimum distance of 50 metres from the buildings.
Level of impact:	No direct impact
Effects on setting:	Insignificant
Mitigation required:	No

15.3.3.5 Meagher's Quay

Plate 15.15 Meagher's Quay in the vicinity of the proposed bridge

Meagher's Quay lies to the west of the junction of Barronstrand Street with the quays and to the west of the proposed landing of the southern end of the proposed bridge. Some of the buildings fronting Coal Quay are protected structures, including number 67, which is next but one to the corner of Barronstrand Street and about 60m from the site of the proposed bridge. This building is seen second from left in the photograph. Meagher's Quay is also within the South Quays Architectural Conservation Area.

Date of construction:	Varied
Protected structure?:	There are three protected structures in Meagher's Quay
Special interest:	Architectural
Special interest rating:	Regional
Impacts on built heritage:	There will be no direct impact. The proposed bridge will land on the southern quays at a minimum distance of 60 metres from the buildings.
Level of impact:	No direct impact
Effects on setting:	Insignificant
Mitigation required:	No

15.3.3.6 Edmund Rice Bridge

Plate 15.16 Edmund Rice Bridge

Edmund Rice Bridge lies upstream, to the west, of the site for the proposed bridge. The bridge is constructed with linear groups of concrete piles that support the reinforced concrete deck. In the centre of the bridge there is a lifting section

Date of construction:	1986
Protected structure?:	Formerly a protected structure, reference 713, though now removed from the Record of Protected Structures
Special interest:	Architectural, historical, social, technical
Special interest rating:	Regional
Impacts on built heritage:	There will be no direct impact. The proposed bridge will be approximately 560m downstream from Rice Bridge. The bridge will provide a vantage point from which Rice Bridge may be viewed.
Level of impact:	No direct impact
Effects on setting:	Insignificant
Mitigation required:	No

15.3.3.7 Sion Hill

Plate 15.17 Sion Hill, with river front at Ferrybank in foreground

Sion Hill is an early-nineteenth century house on a site above Dock Road, overlooking the river and the city. It is two-storey and three-bay with a hipped roof and a rendered façade. The façade is rendered and painted and adorned with a prostyle tetrastyle portico.

Date of construction:	c.1820
Protected structure?:	Yes, reference WA730 107
Special interest:	Architectural, historical, social
Special interest rating:	Regional
Impacts on built heritage:	There will be no direct impact. The proposed bridge will be within view of the front of the house, but would not have a significant impact.
Level of impact:	No direct impact
Effects on setting:	Insignificant
Mitigation required:	No

15.4 Description of Potential Impacts

There would only be one direct impact on a structure of architectural heritage significance arising out of the construction of the proposed bridge. The connection to the proposed bridge on the northern side would require provision of a breach in the rubble stone wall of the access ramp to North Wharf near the bridge over the railway. This ramp is a protected structure.

There will likely be positive impacts arising from the facility afforded by the proposed bridge for viewing the significant architectural heritage. In particular, the bridge will provide a good vantage point for views of Edmund Rice Bridge and the approach towards the south quays will highlight the Clock Tower direction in front of the viewer walking on the bridge. The bridge will also provide good views of the buildings along the frontage of the quays.

15.5 Mitigation Measures

Meagher's Quay

Mitigation will be required on Meagher's Quay where the landing of the new bridge will be located, necessitating the formation of a breach in the stonework of the quay. This should be mitigated by making good either side of the breach in the wall with stones salvaged in the works and laid in a lime-based mortar to match the stonework of the original wall.

Any cut stone removed from the quay wall or the surface of the quay is to be reused in a similar manner or, where this is not possible or appropriate, the stone is to be salvaged and stored for future use elsewhere along the quays.

Following mitigation, the expected impact on the character of the quay would be slight.

Clock tower

Mitigation will be required to safeguard the clock tower during the works. The clock tower is to be excluded from the working area and the hoarding surrounding the working area is to be located outside the ring of post-and-chain fencing around the northern, eastern and western sides of the tower.

Prior to the commencement of works and prior to the erection of the site hoarding a detailed photographic record of the clock tower is to be made showing both the interior and the exterior of the tower. A report based on this photographic survey is to be prepared and lodged with the Conservation Officer, with a copy also lodged with the Waterford City and County Libraries Central Library. The cast iron bollards around the Clock Tower are protected structures and care will be taken to ensure that there will be no damage to the bollards during construction works. The bollards will be removed during construction and relocated within the South Plaza during operation.

Prior to the commencement of the works on the quays a vibration monitor is to be set up within the clock tower and this is to have the facility to send an alarm to a designated engineer in the event of the vibrations within the tower exceeding a predetermined limit to be set by the engineer at a level below which any damage to the tower through vibration is likely to occur.

15.6 Residual Impacts

The residual impact on the approach ramp to the North Wharf following mitigation would be slight.

There would be no other significant residual impacts.

15.7 Difficulties Encountered

No difficulties were encountered in the compilation of this chapter.

15.8 References

An Act for better regulating the Police of the City of Waterford, 23-24 Geo III, c.LII.

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Chapter 16
Material Assets and Land

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Chapter 16 Material Assets and Land

16.1 Introduction

This chapter of the EIAR discusses the impact of the proposed River Suir Sustainable Transport Bridge on Material Assets and Land which includes economic and cultural assets.

Other impacts on Material Assets and Land are also addressed throughout this EIAR, particularly in the following sections:

Table 16.1 EIAR Chapters Relevant to Material Assets

Chapter	Title	Relevant Aspect
5	Traffic and Transport	Loss of Parking
6	Population and Human Health	Human beings
8	Soils & Geology	Natural Resources
9	Hydrogeology	Groundwater
10	Hydrology	Water
11	Landscape and Visual	Views
12	Noise and Vibration	Noise environment
13	Air Quality and Climate	Air Quality
14	Archaeological and Cultural Heritage	Cultural Assets
15	Architectural Heritage	Architectural Assets

Material assets are defined as physical resources in the environment, which may be either of human or natural origin. A development may affect material assets if it involves any of the following:

- Acquisition of land;
- Demolition of buildings;
- Revaluation of or change in the development potential of adjoining lands / properties; or
- Restructuring of city dynamics.

The lands required for the proposed development have already been acquired by Waterford City & County Council as part of a Compulsory Purchase Order (CPO) approved by An Bord Pleanála (PL24 .CH3344) in October 2018. The proposed development will also involve the lease of foreshore subject to a separate application to the Department of Housing, Planning and Local Government Marine Planning – Foreshore Unit and the removal of a section of marina. A property in this context includes residential, commercial and community property and lands which are zoned for development or have planning permission.

This assessment also identifies the positive impacts that this proposed development will have, such as the amenity the development will provide.

16.2 Methodology

In order to address the potential impacts to material assets, a number of impact categories have been examined, including:

- Demographics, employment, tourism and cultural assets;
- Community facilities including journey times, social activities and severance;
- Traffic and public transport;
- Utilities; and
- Marina and river navigation

This chapter describes the receiving environment, determines the significance of the impact of the proposed development on material assets and presents mitigation measures which will be implemented to alleviate impacts. The assessment methodology has considered the following guidelines:

- Advice notes on current practice in the preparation of Environmental Impact Statements (Environmental Protection Agency (EPA), 2003);
- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002);
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008); and
- Guidelines on the Treatment of Tourism in an Environmental Impact Statement (Fáilte Ireland, 2007).

The following draft guidance documents have also been consulted:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft May 2017; and
- Advice Notes for Preparing Environmental Impact Statements, Draft September 2015.

Reference has also been made to the detailed guidelines provided in the UK Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Environmental Assessment Techniques, particularly Part 6 'Land-use' and Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects'.

The methodology for the assessment of the significance of impact on material assets comprised of a desktop survey of available mapping and information to identify the baseline environment. The following sources of information were consulted in the process of this assessment:

- 2016 Census of Ireland; Central Statistics Office (CSO) 2016;
- 2011 Census of Ireland; CSO 2011
- Waterford City Development Plan 2013-2019 – Planning and zoning objectives and mapping;
- Kilkenny County Development Plan 2014-2020;
- Ferrybank Belview Local Area Plan 2017;
- Pobal.ie Mapping
- Myplan.ie Mapping; and
- Fáilte Ireland studies and reports on cycleways.

In addition to the sources listed above, aerial photography and a site layout plan of the existing area and proposed development were consulted. Site visits have also been carried out throughout the project.

16.3 Existing Environment

16.3.1 Land

The land at the north and south landing points are owned by Waterford City and County Council. The south landing area however is leased to a company who currently operate it as a car park. This area and the adjacent road have been subject to the compulsory purchase order (CPO) process from the respective business interests. Furthermore, the marina at pontoon C (hereafter referred to as the floating jetty) which is being removed as part of the proposed development, is owned and operated by Waterford City and County Council. The construction of the proposed piers in the River Suir are subject to a foreshore licence which is being applied for as part of the project. The proposed bridge will connect Waterford City centre with the development within the North Quays Strategic Development Zone (SDZ). Therefore, it is key infrastructure for the successful development of the north quay lands, as identified in the National Planning Framework: Ireland 2040 Our Plan, the North Quays Strategic Development Zone Planning Scheme, the Waterford City Development Plan and the Waterford and Kilkenny Planning and Land Use Study.

16.3.2 Demographics, Employment, Tourism and Cultural Assets

Waterford City is recognised as a Gateway City in the South East of Ireland and is the largest economic centre in the South East. The economic activity of the city is dominated by the commercial, retail, industrial and tourism industries. Additionally, major sources of employment within the city include the Health Service Executive (HSE), government offices, the Department of Education and Waterford Institute of Technology (WIT).

Waterford City is the largest urban area in the South East of Ireland and is an important tourism centre with good transport linkages for both public and private transport. Waterford City is located within Ireland's Ancient East which is a Fáilte Ireland tourism initiative, see Plate 16.1. The aim of the initiative is to attract visitors to areas in Ireland which are renowned for historical features. It is expected that tourism will increase in Waterford City and County as a result of this investment and promotional drive.

The 2016 Census employment data for the Waterford City 'Centre A' ED shows that there were 293 people working in this ED and the Ferrybank ED shows that 310 people were working in this ED. Commerce and trade were the largest industries in the Waterford City Centre A ED followed by professional services and manufacturing. Professional services was the largest industry in the Ferrybank ED followed by manufacturing industries and commerce and trade.

Plate 16.1 Image Presenting Ireland's Ancient East, Source: www.irelandsancienteast.com

Waterford City 'Centre A' had a labour force population of 702 in the 2016 Census. Out of this population, 87 were recorded as unemployed having lost or given up a previous job. Ferrybank ED had a labour force population of 754 in the 2016 Census. Out of this population, 65 were recorded as unemployed having lost or given up a previous job. On foot was reported as the most popular means of travel to work in Waterford City 'Centre A' whilst the car was the most popular means of travel to work in the Ferrybank ED.

16.3.3 Community Facilities

In terms of community facilities, the city offers a large selection of restaurants, cafes, hotels, bars and shops along with visitor attractions such as museums. These facilities have developed in the area over many years and provide important attractions to potential visitors. Additionally, a number of shopping centres of regional importance are located in close proximity to the study area including City Square Shopping Centre and George's Court Shopping Centre.

Within the study area, the marina and the car parks are the most important community facilities. The marina is an important facility for local and visiting boat owners. Waterford City hosted the 2005 and 2011 Tall Ships Races which attracted approximately 500,000 people to the city. In addition, people within Waterford City use the existing river front walkway along the South Quay on a regular basis for recreational purposes.

There are a number of sports facilities located within and on the outskirts of the city. The Waterford Greenway, Ferrybank Sports Ground, the Regional Sports Centre and Carriganore Sports Campus are important sports facilities in the outskirts of the city.

16.3.4 Traffic and Public Transport

The road transport network within the study area is comprised of a walkway along the South Quay river front, the R680 regional road and the R711 Dock Road along the North Quay. Cycle lanes and footpaths are provided in both directions along the R680 but no cycle facilities currently exist along the R711 Dock Road, resulting in a hostile environment for cyclists as they are required to compete with heavy, fast flowing traffic. Waterford City is connected to major surrounding regions, towns and cities through bus and train services and there is a high concentration of commuting traffic to, from and through Waterford City.

16.3.5 Utilities

The underground and overhead utilities were mapped at the River Suir Sustainable Transport Bridge location using services record data followed up with site reconnaissance. The following utility providers were contacted to request services records:

- Gas Networks Ireland
- ESB (Electricity Supply Board)
- Irish Water
- Virgin Media
- EIR
- Local Authority (Public Lighting, Stormwater, Drainage and Traffic)
- Telecoms/ Cable TV/ Broadband: EIR, Vodafone, Aurora Telecom, BT, Centrecom, Three Ireland, ENET, Virgin Media, ESB Telecoms

Responses were received from all providers with the exception of Aurora Telecom and Three Ireland. Centrecom, ESB Telecoms and Vodafone fixed apparatus have confirmed that they do not have any services in the area.

No overhead services are present. The following services have been identified at the River Suir Sustainable Transport Bridge landing area on the South Quays;

- Gas Network Ireland services
- ESB Medium Voltage (MV)/ Low Voltage (LV), lighting, underground
- Irish Water watermains
- Local Authority (Sewer mains, traffic cables, public lighting)
- Telecom/ Cable TV/ Broadband (BT, EIR, ENET and& Virgin Media)

Information obtained from the 2007 report "Waterford City Centre Pedestrian Bridge – Design Options Report – October 2007" highlights that a number of services exist at the South Quay landing area, namely Bord Gais, Eircom and ESB network services.

The public lighting and power services running parallel to the quay will require diversion as part of the bridge works. The other services listed in Table 16.2 will require diversion/protection as part of the bridge southern approach being developed by WCCC. The requirement for this will be investigated at detailed design stage. No diversions will be required on the North Quays.

16.3.6 Marina and River Navigation

The floating jetty parallel to Meagher's Quay at the Clock Tower, is owned and operated by Waterford City and County Council (WCCC). The pontoon is 238m in length and is capable of receiving vessels on both the river side and the land side. The pontoon comprises a fixed platform and floating jetties which are retained in position using tubular steel piles. Construction works will involve the removal of 5 piles from the existing pontoon and the provision of 4 new piles.

While the marina is currently at approximately 70% occupancy, it is hoped that capacity will increase to 100% occupancy in the future. The marina receives approximately 150 visiting vessels during the summer months (April to Oct).

The floating jetty is designed to accommodate 40 vessels. The pontoon is used all year round and is busiest during the summer months. There is an existing security gate for accessing the pontoon which requires a code to operate. However fencing at both sides of the security gate is currently inadequate as it is mountable.

The floating jetty is a popular berthing area as the River Suir is deep at this section and is not affected by silting. It is also popular as it is close to the city centre and has a number of adjacent facilities for boat owners including wifi, showers, toilets and laundry facilities.

The average vessel length is approximately 9.7m. The maximum vessel length using the jetty has been observed as approximately 34m. The average vessel breadth is approximately 3.3m and the maximum vessel breadth is approximately 5.1m.

Two commercial companies are located upstream of Rice Bridge (Fastnet Shipping Ltd. and South East Tug Services Ltd.). Furthermore, during storms, fishing trawlers moor upriver, just below Rice Bridge on both north and south wharfs. The opening span of the Rice Bridge is 25m, however the largest breadth of vessel currently travelling along the River Suir in Waterford City is approximately 18.3m and the average vessel breadth is approximately 13m.

There is a requirement to remove two sections of the existing South Quay flood wall to allow the construction of a relocated and a new gangway to the re-configured marina jetties, to the east and west of the existing jetty.

16.4 Predicted Impacts

16.4.1 Construction Impacts

16.4.1.1 Demographics, Employment, Tourism and Cultural Assets

The construction phase is not expected to have a significant impact on the demography, employment, tourism or cultural assets of the area due to the scale of the project. It is anticipated that approximately 20-25 construction workers will be employed over a period of approximately 18 months. While the nature of the construction works will not be attractive to tourists due to visual, noise, air quality and traffic impacts, the small nature of the construction works will not result in significant impacts with regards to the tourism of the area.

The overall impact on demographics, employment, tourism and cultural assets is considered to be minor, temporary and negative.

16.4.1.2 Community Facilities

The construction phase will cause a certain amount of loss of amenity, disruption and inconvenience to residents and visitors. This disruption and inconvenience will be related to traffic and also to the generation of noise and dust, issues which are commonly associated with the construction of infrastructure projects.

Access will be maintained for vehicles, pedestrians and cyclists along the R680 and along Dock Road at all times during the construction phase. The existing riverfront walkway along the South Quay will be obstructed during construction and recreational users will be required to cross the R680 for a short section during this period. Several pedestrian crossing facilities in the vicinity of the proposed bridge location will assist in the provision of this diversion.

Construction activity associated with the proposed development will give effect to temporary impacts on surrounding commercial and residential receptors due to:

- Construction noise;
- Dust emissions;
- Restricted access; and
- Disturbance of services.

The activity of machinery and transport vehicles will generate noise emissions in the immediate vicinity of the proposed site. Furthermore, dust generated during construction may cause annoyance or nuisance to recreational users of the South Quay, business owners and surrounding residents.

The removal of car parking spaces to the west and east of the Clock Tower during construction has the potential to impact on convenience for car users and therefore impacts upon business in this area of Waterford City.

16.4.1.3 Traffic and Public Transport

During construction, the R711 Dock Road and the R680 will remain open to vehicular traffic, pedestrians and cyclists at all times. The riverfront walkway will be temporarily obstructed by the construction site. The overall impact on traffic and public transport is considered to be minor, temporary and negative during construction. Traffic and public transport impacts are discussed in Chapter 5 Traffic and Transport.

16.4.1.4 Utilities

The public lighting and power services running parallel to the South Quay will require diversion as part of the construction works. The other services listed in Table 16.2 will require diversion/protection as part of the bridge southern approach.

On the North Quays no diversions will be required because the existing watermains will be removed to facilitate the SDZ proposal.

The use of the floating jetty will be prohibited during construction.

Table 16.2 Existing Services Impacted by the Construction of the Proposed Development

North Quays
Watermains
South Quays
Rising Main (protection required)
Storm Water (local carpark)
ESB Underground
Telecom Underground (ESB)
Public Lighting Underground
Bord Gais
Traffic Light Underground
Unidentified Underground Services have also been picked up by GPR survey

16.4.1.5 Marina and River Navigation

There will be a permanent loss of approximately 140m of berthing facilities from the existing Waterford marina which will result in *a* permanent negative impact. The construction phase will require the permanent re-location of vessels currently using the marina at the proposed crossing point to an alternative marina downstream. Re-organisation of the existing vessel arrangement will be required.

The construction of the piers will be carried out from a jack-up barge, the position of which will impact upon upstream and downstream navigation and navigable access to the marina, however sufficient space will be available at all times.

Construction works will prove inconvenient to the marina berth-holders but dredging works, the Tall Ship's Races and various other events in the past have required the temporary relocation of vessels from the floating jetty and a similar process can be put in place to seamlessly rearrange the vessels as necessary. Noise and dust emissions generated during construction may cause annoyance to marina users. The east Marina (located at the Millennium Plaza) will remain operational during construction and operation of the proposed development.

16.4.2 Operational Impacts

16.4.2.1 Demographics, Employment, Tourism and Cultural Assets

The operation of the proposed development will encourage tourism in the area and will maintain commercial and residential rents and property values. It is predicted that the development will result in an increase in population in the wider local area which will result in an increase in demand for housing and development and for local services, thereby enhancing economic activity and employment within the area. The proposed development will add to the existing tourist amenities in the area.

The project will bring a greater demand for facilities associated with tourism and will benefit existing businesses in the area, in particular in the service sector (hotels, cafes, restaurants etc.). Waterford City Development Plan 2013-2019 highlights the need to focus on sustainable tourism. There is the potential for Waterford City to become a cycling hub, acting as a link between the Waterford Greenway and the New Ross to Waterford Greenway, thus further increasing the positive economic impact of the proposed development. Cycle tourism is a growing market and cycle tourists tend to stay longer in a destination and therefore have more time to add to the local economy.

Furthermore, the proposed development will be a key piece of infrastructure providing connectivity between Waterford City centre and Ferrybank, the proposed transport hub and the proposed development within the North Quays SDZ.

16.4.2.2 Community Facilities

The most significant negative impacts of the operation of the proposed development to those living in and using the area include the removal of 150 car parking spaces to the east and west of the Clock Tower and the removal of approximately 140m of berthing facilities. The removal of the section of the floating jetty and its subsequent non-re-instatement will result in a 20% loss in berthing facilities for the marina and a corresponding 20% loss in revenue. The bridge will provide pedestrian access to additional parking facilities on the north quays, commensurate with the scale and type of city centre development which is planned for the Strategic development Zone.

There will be no severance of facilities or direct loss of land for residential or commercial properties as part of the proposed development. The operation of the proposed development will have an overall positive impact on community facilities due to enhanced accessibility and attractiveness of the area which in turn will encourage tourism in the area and will maintain commercial and residential rents and property values.

The development will be accessible from nearby schools, community facilities and workplaces and will therefore improve pedestrian, cyclist and public transport accessibility to these facilities. Schools along Abbey Road in Ferrybank will benefit greatly from the proposed development due to the increased connectivity with these schools and Waterford City Centre.

Encouraging sustainable transport modes has the potential to improve the quality of life for people locally. There has been an increasing issue of rising obesity levels in Ireland in recent years, with the World Health Organisation (WHO) describing it as a 'global epidemic'. Sustainable modes of transport, including walking and cycling, enhances personal health, fitness and well-being. Sustainable transport can also improve the local air quality and noise pollution levels, having a positive impact on human health.

During operation, it is not considered that there will be significant effects experienced due to light pollution or privacy impacts as the area is currently a well-lit, urban area. There is the potential for increased anti-social behaviour and a greater risk to security due to the increase in numbers of passers-by and due to the proximity of the proposed bridge with the marina. However, it is expected that the provision of an open and lit area will deter groups from loitering due to the increased visibility.

The proposed development is a crucial piece of infrastructure which will enable the concentric development of the city and will provide for an increase in population of 30, 000 people on the north side of the River Suir, in line with the targets set out in the National Planning Framework (NPF).

The connectivity of Ferrybank and the SDZ development with Waterford City Centre is a huge benefit to the local and surrounding communities. The vitality, vibrancy and quality of life that this proposed development will bring to Waterford City and Ferrybank will be a major positive impact to the city and the region. The development will enhance the attractiveness of the city for residents, businesses and tourists.

16.4.2.3 Traffic and Transport

The proposed development will provide safer traffic and transport facilities as cyclists and pedestrians will have alternative transport options. During operation the proposed development is expected to have positive impacts on air quality and noise pollution due to the consequent removal of vehicular traffic from the area.

Bridge will allow for greater connectivity by alternative and sustainable means of transport to the north side of the river.

16.4.2.4 Utilities

It is not proposed to provide subterranean utility connection across the opening span of the new bridge. However, two service troughs will be included along the length of the bridge such that in the event that the river is closed to larger vessel traffic at a future date, and the bridge is no longer required to open, the ends of the opening span bascule sections could be permanently closed (welded) providing a continuous trough for services for the length of the bridge. The bridge abutment structure will provide suitable openings in the ballast wall in line with the bridge deck trough to allow services to pass without future modifications.

16.4.2.5 Marina and River Navigation

The removal of the upper section of the floating jetty and subsequent non-re-instatement of same will result in a 20% loss in berthing facilities and a corresponding 20% loss in revenue. All vessels currently berthing at the floating jetty will be accommodated elsewhere in the marina during operation.

Approximately 20 berths will be permanently removed from the floating jetty and relocated to a jetty approximately 470m downstream. These 20 berths comprise 14 long-term berths and 6 visiting berths.

The existing security gate for the marina is adequate for the likely increase in passing traffic. However, the fencing approaching the gate will require replacement and will need to be improved as it is currently possible to access the jetty at the sides of the gate.

It is expected that the increased numbers of passers-by will reduce the occasion for anti-social behaviour. Furthermore, it is expected that the provision of an open and lit area will deter groups from loitering.

16.5 Mitigation Measures

16.5.1 Construction

During construction, the following mitigation measures are proposed for the River Suir Sustainable Transport Bridge:

- Measures to control the production of dust will be put in place by the contractor (refer to Chapter 13 Air Quality and Climate which presents a series of measures to control dust);
- Noise mitigation will be provided during construction of the development. Measures to mitigate noise impacts on sensitive receptors are detailed within Chapter 12 Noise and Vibration. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities.

- A Traffic Management Plan will be implemented during construction in order to minimise disruption to local residents, commercial business operators and the general public.
- Access will be maintained for vehicles, pedestrians and cyclists at all times during the construction phase.
- The new drainage system along the South Quay will be designed to ensure that the current drainage situation will not be impacted and there will be no increased risk of flooding as a consequence of the River Suir Sustainable Transport Bridge;
- Any services that are interfered with, including services to the marina, as a result of the proposed development will be repaired or replaced without unreasonable delay;
- It is anticipated that a combination of a sufficiently open and lit area will be enough to prevent groups from congregating. More secure gates will be installed at the marina gangways to ensure a higher level of protection for boat owners as a result of increased numbers of passers-by;
- Communication will be maintained with the Port of Waterford and the Harbour Master during construction works;
- Compensatory car parking spaces are available across Waterford City. New car parks have recently opened in the city. Directional signage will be erected to assist visitors. The development of the SDZ area will result in increased parking facilities in the area; and
- The removal of berths will be compensated at the marina downstream.

All construction works will be temporary and will be carried out in line with best practice guidelines thus minimising the impacts to the receiving communities. The contractor will work within stringent construction limits and guidelines to protect surrounding amenities. As discussed in Chapter 4 of this EIAR, a Construction Environmental Management Plan (CEMP) will be implemented by the contractor and will ensure commitments included in the statutory approvals are adhered to.

Further specific mitigation measures related to Material Assets are described in Chapter 5 Traffic and Transport, Chapter 11 Landscape and Visual, Chapter 12 Noise and Vibration and Chapter 13 Air Quality and Climate of this EIAR. All mitigation measures are summarised in Chapter 18 of this EIAR.

16.5.2 Operation

The majority of impacts relating to Material Assets as a result of the proposed development are positive. Specific mitigation measures related to material assets include the replacement and improvement of the existing security fencing approaching the gate to the jetty. This will be required as a result of the increased numbers of passers-by and to deter anti-social behaviour. Security cameras and suitable lighting will also be installed to prevent loitering and anti-social behaviour. During operation, the vitality and vibrancy that this proposed development will bring to Waterford City will be a major benefit to the city and the South-East region of Ireland.

16.6 Residual Impacts

There will be no adverse residual impacts on material assets as a result of the proposed River Suir Sustainable Transport Bridge subject to adherence to best practice and implementation of the mitigation measures outlined in the relevant EIAR chapters. During the construction phase the removal of berths from the floating jetty and the removal of 150 car parking spaces will cause some disruption. Disruption during the construction phase will be temporary in nature and minor in magnitude.

The vitality and vibrancy that this proposed development will bring to Waterford City through linkages and connectivity will be a major benefit to the city centre and throughout the region. During operation, the proposed development will provide an additional amenity to the area with positive impacts for the local community, residents and business owners with regard to increased tourism, economic benefits and potential health improvements. It is predicted that the development will attract many users once in operation. The proposed development has the potential to positively restructure the dynamics of the city and revaluate or change the development potential of adjoining lands / properties.

Table 16.4 Assessment of the Impact of the Proposed Development on Material Assets

Impact	Receptor Type	Positive/ Negative	Impact Significance	Mitigation	Residual Impact
Employment during construction	Employment	Positive	Slight	Not required	Slight
Discouragement of tourism during construction	Tourism	Negative	Moderate	Best practice guidelines will be followed by the Contractor to minimise disruption. Contractor will adopt and adhere to all mitigation in this EIAR.	Slight
Obstruction of riverfront walkway during construction	Community Facility	Negative	Slight	No mitigation proposed. Recreational users of the riverfront walkway will be directed to cross to the other side of the R680 for this short section. The footpath on the south side of the R680 will be capable of receiving the additional footfall.	Slight
Nuisance during construction (noise and dust emissions)	Residents, visitors, business owners	Negative	Moderate	Dust Management Plan will be put in place. Best practice guidelines will be adhered to by the Contractor, particularly in regard to noise levels and working hours.	Slight

Impact	Receptor Type	Positive/ Negative	Impact Significance	Mitigation	Residual Impact
Removal of 150 car parking spaces from the South Quay	Residents, visitors, business owners	Negative	Moderate	Compensatory car parking spaces are available in City Square Shopping Centre, Railway Square Car Park, Waterside Car Park and Clyde Wharf Car Park.	Slight
Utility diversion	Marina users	Negative	Slight	All utilities will be repaired or replaced without unreasonable delay	Slight
Loss of section of berthing facilities	Marina users	Negative	Significant	Relocation of vessels downstream	Moderate
Navigation impacts due to presence of jack-up barge in the river	River users	Negative	Moderate	Communication with the Port of Waterford and the Harbour Master during construction. Ensure navigation passage available at all times.	Slight
Enhancement of the service industry and tourism during operation	Tourism	Positive	Moderate	Not required	Moderate
Enhancement of economic activity	Residents, visitors, business owners	Positive	Moderate	Not required	Moderate
Enhanced accessibility to services and facilities	Residents, visitors, business owners	Positive	Significant	Not required	Significant
Improved quality of life for locals	Residents, visitors, business owners	Positive	Significant	Not required	Significant
Improved air quality and reduced noise pollution	Residents, visitors, business owners	Positive	Slight	Not required	Slight
Reduced anti-social behaviour	Residents, visitors, business owners	Positive	Moderate	Improved fencing leading to the marina security gate on the South Quay. Security cameras will be installed and the area will be suitably lit.	Slight

16.7 Conclusions

The construction of the proposed sustainable transport bridge will potentially increase the walking catchment from the City Centre to the areas north of the River Suir to include a population of approximately 4,000 people, and the cycling catchment to include 7,400 people, in line with the NPF which predicts a future population of 30, 000 people on north side of the River Suir. It is expected that, as the proposed development will connect the existing Déise Greenway with the proposed Waterford-New Ross greenway, it may attract approximately 150,000-200,000 users annually. Furthermore, Barronstrand Street carries approximately 2.3 million users annually. If the retail spine is to continue to the proposed shopping centre within the north quays SDZ in the future, it is predicted that the bridge may carry approximately 4 million users annually.

It is considered that the proposal will have limited adverse impacts during the construction phase which is, by its nature, temporary. The removal of 150 car parking spaces from the South Quay and the removal of approximately 140m^2 of berthing facility from the floating jetty are considered the most significant permanent impacts associated with the project. In contrast, the operation of the development will provide many significant positive impacts to the city and wider region. Specific significant positive impacts relating to the operational phase of the proposal include:

- Providing alternative sustainable transport options including cycling, walking and public transportation along a safe and secure route which is segregated from private vehicles;
- Providing indirect health benefits through the provision of safer facilities for recreational users which will increase and encourage the opportunity for physical exercise;
- Providing connectivity to the proposed transport hub on the north quay, including the relocated train station;
- Providing a new amenity for Waterford City, thereby enhancing the attractiveness of the city to tourism and increasing the economic potential of the city;
- Providing linkages and connectivity, thereby enabling the concentric development of the city which, when realised, will act as an economic driver for the region. Aiding integration of the SDZ with Waterford City and the integration of the North Quay and the South Quay. Aiding integration of the existing Waterford Greenway and the proposed New Ross to Waterford Greenway and aiding integration of the Ferrybank area, particularly schools on Abbey Road, with Waterford City; and
- Providing positive impacts on material assets due to enhanced accessibility and attractiveness of the area which in turn will maintain commercial and residential rents and property values.

Chapter 17
Major Accidents, Interrelationships and Cumulative Impacts

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Chapter 17 Major Accidents, Interrelationships and Cumulative Impacts

17.1 Introduction

This chapter presents the vulnerability of the proposed development to risks of major accidents and/or disasters. In addition, the interrelationships between individual topics discussed in previous chapters of this Environmental Impact Assessment Report (EIAR) have been considered in this chapter. The predicted interactions between these environmental topics are presented in Table 17.1. The cumulative impacts of the proposed development with those of previous development, current development in planning, and proposed future developments which are reasonably foreseeable have also been assessed and are described in this chapter. Potential transboundary impacts are also assessed.

17.2 Methodology

17.2.1 Vulnerability to Risks of Major Accidents and/or Disasters

A major accident is defined as an event that threatens human health, welfare and/or the environment. Major accidents can result in the loss of life, permanent injury or long-lasting damage to an environmental receptor. This section comprises an assessment of the vulnerability of the proposed development to risks of major accidents and/or disasters.

An understanding of the potential consequences of major accidents and disasters due to the proposed development was gained through a desktop study comprising reviewing available documentation and legal and regulatory requirements. This desktop study was carried out to identify potential hazards associated with major accidents and/or disasters, their likelihood, and the potential resulting consequences. During the desktop study, an understanding of common region-specific accident and/or disaster events was obtained in order to predict the potential consequences of such major events in the context of the proposed development. As the assessment of major accidents and disasters is a new requirement of the EIA Directive 2014/52/EU and national guidelines are not yet available, the desktop study consulted Highways England's (equivalent body to Transport Infrastructure Ireland (TII)) guidance.

The proposed development has been designed in accordance with best practice guidelines to ensure that it will be built, operated and maintained safely and without risk to health, in compliance with all relevant health and safety legislation, thereby mitigating many risks.

During this assessment, hazards were identified and screened, the impacts were defined and the likelihood of impacts occurring were assessed. Mitigation measures were considered and the remaining risks were then assessed. Only risks with a feasible source-pathway-receptor model were considered as part of the assessment. Risk events which do not have all three components were screened out from the assessment. Environmental receptors considered for this assessment included members of the local public, the built environment, the natural environment and the historic environment. For this assessment, a significant adverse effect is considered to mean the loss of life or permanent injury, and/or permanent or long-lasting damage to an environmental receptor. The significance of the effect takes the extent, severity, duration of harm, and the sensitivity of the receptor into account.

17.2.2 Interrelationships

The determination of interrelationships was facilitated through an iterative design process that included meetings between designers and specialists where strong interrelationships exist. In addition, the process was informed by consultation with statutory and non-statutory consultees and in particular with the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (National Monuments Service and National Parks and Wildlife Service) and Inland Fisheries Ireland (IFI). Where a potential exists for interaction between two or more environmental topics, the relevant specialists have taken these into account when making their assessment. Where necessary, mitigation measures have been proposed.

17.2.3 Cumulative Impacts

The geographical boundary selected for assessment of cumulative impacts comprises a viable Study Area holding potential for feasible cumulative impacts whilst excluding those areas which are non-viable because of issues such as topography and distance.

Cumulative impacts are impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the River Suir Sustainable Transport Bridge. Cumulative impacts were assessed by looking at all previous plans and projects, current plans and projects in planning and proposed future plans and projects within 15km of the proposed site location from 2008 to the present. There is too much uncertainty associated with development proposals beyond 5 years into the future and this EIAR can only be based on data that is readily available. This cumulative assessment has considered cumulative impacts that are:

(a) Likely;

(b) Significant; and

(c) Relating to a future event which is reasonably foreseeable

Data sources included the following:

- Waterford City and County Council (planning and roads sections);
- Kilkenny County Council (planning and roads sections);
- An Bord Pleanála website (planning searches);
- Web search of windfarm projects in Waterford City and County and Co. Kilkenny;
- Web search for major infrastructure projects in Waterford City and County and Co. Kilkenny;
- Waterford City Development Plan 2013-2019;
- Waterford County Development Plan 2011-2017;
- Kilkenny County Development Plan 2014-2020;
- Ferrybank Belview Local Area Plan 2009-2020 (including Amendment 1);
- Coillte Website;
- IFI website; and
- The National Spatial Strategy 2002-2020.

17.3 Major Accidents and/or Disasters

It is considered that the three main areas of potential for major accidents and/or disasters relevant to the project are:

- Proximity to Seveso sites;

  There is one Seveso (Control of Major Accident Hazards (COMAH)) site in proximity to the proposed development. Trans Stock Warehousing and Cold Storage Ltd. is a chemical warehouse, located approximately 1km to the east of the proposed development. As the proposed development is outside the 700m consultation radius for the site, the proposed development was not required to be referred to the Health and Safety Authority. Therefore, due to the distance of from the site, it is predicted that there will be no likely significant impact as a result of the proposed development.

- Weather Events;

  The assessment identified that weather events are the principal hazards encountered with respect to bridge operation, including rainfall, wind and ice and their potential contribution to natural disasters and major accidents such as collisions. Flooding is a likely event that may occur in the vicinity of the River Suir and impacts associated with flooding are examined in Chapter 10 Hydrology of this EIAR.

  The principal objectives for the proposed drainage system include:

  - To provide improved water quality by means of treatment prior to discharge;
  - To ensure that the impact of the drainage outfalls on the receiving River Suir is negligible; and
  - To minimise the impact of runoff on the receiving environment.

  The bridge deck elevation has been profiled to allow a freeboard for both the combined 1% Annual Exceedance Probability (AEP) fluvial and 0.5% AEP tidal flood level (obtained from "*Suir CFRAM Study, Hydraulics Report, July 2015*") and the design flood level (200 year tide + 100 year fluvial flood) obtained by the hydraulic model developed for the North Quays Strategic Flood Risk Assessment (SFRA) by Roughan & O'Donovan Consulting Engineers, "*Waterford North Quays, Strategic Flood Risk Assessment",* document no. 16.169.10/SFRA 001 Rev D, dated 6th October 2018. The calculated 200-year tide combined with 100-year fluvial flood is +3.47mOD.

  At the northern approach of the bridge, the deck elevation is flat, and has its highest point at the North Quay abutment (+8.00 mOD, measured at the top of the deck). The lowest point of the deck elevation is at the South Quay abutment (+4.42 mOD, measured at the top of the deck). The proposed deck elevation over the majority of the 207m span is significantly higher than the calculated extreme flood events. An OPW Section 50 report, "*Hydraulic Modelling of Proposed River Suir Sustainable Transport Bridge for OPW Section 50 Approval",* prepared for Roughan & O'Donovan Consulting Engineers by Hydro Environmental Ltd, dated December 2018, Report No. HEL212203 v1.1, has been prepared for the proposed scheme based on the bridge characteristics presented in the figures in Volume 3 of this EIAR. The conclusions of that report state: - "*The effect of the proposed Bridge and support piers is found to have no perceptible impact on flood levels and flood risk under a range of combined tide and fluvial flood events".*

- Risk of Slope Failure

  Karstified rock is not present in the project area which eliminates the impact of failures from karstification. There are no significant slopes associated with the proposed bridge location other than very minor slopes at the south plaza at the south abutment. Rock slopes on the northern shoreline of the River Suir near the existing train station are too distant from the bridge site to have an adverse effect. Therefore, the likelihood of slope failure resulting in impacts on the bridge is negligible.

- Vessel collision with the bridge

  The AASHTO Guide Specification and Commentary for Vessel Collision Design of Highway Bridges was used to determine the most appropriate bridge protection system. The design of a vessel protection system is particularly important given the light nature of this opening sustainable transportation bridge. Bridges with opening spans are particularly susceptible to interrupted service as a result of vessel collision, as even a minor collision event on the substructure or superstructure could cause failure of its electrical or hydraulic equipment. Regarding this, the proposed vessel collision protection system shall be completed independent of the bridge itself. The design of the protection system will ensure that there is no contact of the vessel with the sustainable transport bridge substructure or superstructure when the protection system is in the fully deformed position and the vessel has fully stopped. See the vessel collision protection system presented in Figures 4.2, 4.4 and 4.5 of Volume 3 of this EIAR.

  In addition to the main protection system to the main piers, secondary vessel collision protection systems will be required at the intermediate pier locations. The design ship impact effects at these locations can be reduced based on the lower probability of occurrence due to the greater distance from the navigational channel. The bridge navigational span will be provided with a fender protection system, which prevents vessels from laterally contacting with the bridge deck while the vessel is transiting through. The protection system will be primarily made of steel piles with concrete infill, embedded into rock beneath the river bed. Three no. 1200mm diameter piles will be installed close to each other in proximity of the central pier and 2 no. piles in proximity of the intermediate piers. Because of the reduced probability of collision further from the centre of the navigational channel, a larger number of piles is provided in front of the two central piers. The collision protection system will also be designed in order to reduce their visual impact. In addition, a system of smaller fenders will be installed to provide a visual guide to the ships passing through the bridge.

  Therefore, with all of the above measures in place likelihood major collisions with the bridge deck is considered not significant.

Ensuring the proposed development is resilient to major accidents and disasters includes the provision of warning systems to warn users of incidents in advance of hazards, and the management and operation of the proposed development. The likelihood of the proposed development causing major accidents and/or disasters is negligible. During construction, workers will be vulnerable to accidents while working on site, however the contractor will have a safety statement and safety plan in place which will include procedures to protect their employees while on site.

17.4 Interrelationships

Interrelationships are interactions between the impacts and proposed mitigation for one discipline to either reduce or increase the impact on another associated discipline when considered in combination. An example of this would be the provision of noise barriers to mitigate the impacts of noise on the surrounding environment could have a negative impact in terms of landscape and visual impact.

The impacts of the mitigation provided have been considered by all disciplines to ensure all the interactions have been fully considered within this EIAR.

Table 17.1 shows a matrix of interactions likely to occur for the River Suir Sustainable Transport Bridge. The boxes ticked in Table 17.1 indicate that a potential relationship exists between the two environmental topics.

Table 17.1 Matrix Summarising Key Interrelationships

Receptor / Activity	Traffic and Transport	Population and Human Health	Biodiversity	Soils and Geology	Hydrogeology	Hydrology	Landscape and Visual	Noise and Vibration	Air Quality and Climate	Archaeological and Cultural Heritage	Architectural Heritage	Material Assets
Traffic and Transport		✓	✓			✓	✓	✓	✓		✓	✓
Population and Human Health	✓											
Biodiversity								✓				
Soils and Geology	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Hydrogeology		✓				✓						✓
Hydrology		✓	✓	✓								✓
Landscape and Visual		✓									✓	✓
Noise and Vibration		✓										✓
Air Quality and Climate		✓	✓									✓
Archaeological and Cultural Heritage		✓										
Architectural Heritage		✓										
Material Assets		✓										

17.4.1 Traffic and Transport

Traffic and transport will interact and / or interrelate with the following:

Population and Human Health

The removal of 150 car parking spaces from the Clock Tower car park will remove a facility for road users. To minimise the impact, additional parking has been provided across Waterford City in recent years. During construction, the haulage of materials to and from the site will create a significant temporary impact to both road users and to residents living along haul roads due to the increase in traffic. To minimise these impacts a Traffic Management Plan will be prepared and adhered to for the duration of construction works.

Thee is likely to be positive long-term cumulative effects on journey characteristics, journey amenity, time and reduction in severance as a result of city-wide improvements in the pedestrian and cycle network that will be linked via the proposed development. This includes the Waterford to New Ross Greenway, public realm improvements including green routes proposed in the Waterford City Development Plan.

During the operational phase, positive effects on the population will result due to improved connectivity between Ferrybank and the City Centre, and a general improvement in journey safety, amenity and facilities for public transport, cyclists and pedestrians.

The promotion of walking, cycling and using public transportation will have a significant positive human health effect by improving access for businesses, schools, residents and tourists whilst also realising improved safety and the environmental amenity due to the reduced traffic volumes.

Biodiversity

Increased construction traffic may cause impacts on biodiversity within the River Suir as a result of dust and vehicular emissions during the construction stage, however these impacts will be short term in nature. During the operation stage, emphasis on pedestrian, cycling and sustainable transport traffic will result in positive impacts on biodiversity due to reduced levels of dust and vehicular emissions.

Hydrology

As a result of the provision of a new bridge across the River Suir, there is a risk to water quality through pollution and spillage accident risk. Best practice guidelines will be adhered to during the construction phase to minimise these risks. During the operation of the proposed bridge, the risk of spillage and pollution will be negligible as the bridge will only accommodate pedestrians, cyclists and an electric vehicle.

Landscape and Visual

The increase in construction traffic related to piling rigs, cranes and other plant and machinery will result in temporary negative visual impacts. These impacts will be mitigated through the use of high quality hoarding around the construction site. During operation, the removal of vehicular traffic from Rice Bridge, the encouragement of sustainable modes of transport and the removal of car parking spaces from the Clock Tower car park will represent positive landscape and visual impacts.

Noise and Vibration

During construction, the impact on noise sensitive locations due to construction traffic is likely to be moderate, negative and short term. The temporary nature of the construction period and the variety of machinery used will ensure that no construction activity is operational for long periods. The TII derived guidance limits will be followed as an appropriate target criterion for this assessment and relevant noise mitigation measures will be followed during construction.

The proposed bridge will encourage sustainable modes of transport rather than private vehicles, thereby having a positive noise and vibration impact on the city centre.

Air Quality and Climate

During construction, there is potential for impacts due to dust emissions from construction vehicles. Standard, good practice mitigation measures will be implemented on-site to control emissions of dust and PM_{10} during the earthworks. Such measures are in common use on all well-managed construction sites and will control emissions so that a significant effect does not occur.

During operation, the planned reduction in the use of private car through the encouragement of sustainable modes of transport will have a positive air quality impact on Waterford City and the Ferrybank area.

Climate standards, agreements, policies and strategies will be adhered to during the construction and operation phases and therefore, impacts on climate due to emissions from construction vehicles are not expected as a result of the proposed development.

Architectural Heritage

During operation, the diversion of pedestrians and cyclists across the River Suir at the proposed location will enhance views of buildings of architectural heritage, particularly the Clock Tower.

Material Assets

The removal of 150 car parking spaces from the Clock Tower car park will have a significant negative effect on material assets by reducing access for customers of surrounding businesses. However, alternative car parks have opened across the city in recent years to accommodate this loss of parking facility. During operation, there will be significant positive impacts on tourism due to the new walking and cycling transport option.

17.4.2 Population and Human Health

Population and Human Health will interact and / or interrelate with the following:

Traffic and Transport

The provision of pedestrian and cycle routes connecting to public transport and Waterford City Centre will provide the opportunity for the surrounding population to access these locations by alternative non-motorised forms of transport.

Interactions are also expected due the proposed connection with the existing city centre and the North Quay Strategic Development Zone (NQ SDZ), which will likely increase the population of the area and result in increased traffic in the area.

17.4.3 Biodiversity

Biodiversity will interact and / or interrelate with the following:

Noise and Vibration

It is expected that biodiversity will reduce noise and vibration impacts as the sensitivity of the biodiversity of the River Suir, particularly Twaite Shad, Salmon, River Lamprey and Otter, to noise and vibration impacts has resulted in the implementation of noise and vibration mitigation measures. For example reduced working hours for piling operations are required to reduce noise and vibration impacts on the biodiversity of the River Suir.

17.4.4 Soils and Geology

Soils and Geology will interact and / or interrelate with the following:

Traffic and Transport

During construction, the export and import of materials will increase the volume of heavy goods vehicles travelling in and out of Waterford City. The implementation of the Traffic Management Plan will minimise traffic impacts.

Population and Human Health

With regards to impacts towards the population, the construction of the proposed development will involve the storage of materials. There is potential to create adverse impacts on the local community due to transportation of materials to and from the site due to the resultant air quality, noise and vibration and traffic impacts. Controls and mitigation have been proposed in respective chapters to mitigate these impacts.

Biodiversity

Construction works have the potential to result in disturbance to species during construction through pollution incidents if not fully managed. An outline Environmental Operating Plan has been prepared to provide the minimum level of intervention that would be required by the contractor in the event of a spillage incident, as presented in Appendix 4.2 of this EIAR. Mitigation measures are outlined in Chapter 7 Biodiversity of this EIAR.

Hydrogeology

Piling during the construction of the bridge piers has the potential to reduce the overburden to the aquifer, creating a pathway for pollution. These potential impacts have been assessed and mitigated in Chapter 9 Hydrogeology of this EIAR.

Hydrology

During the construction phase there is the potential for sediment laden run-off from the site to enter the River Suir. As part of the outline Environmental Operating Plan developed, an outline Incident Response Plan and an outline Construction and Demolition Waste Management Plan have also been developed detailing the mitigation that the contractor shall implement to avoid sediment from entering the River Suir during construction.

Landscape and Visual

The construction of the proposed development will involve the transportation of materials to and from the site which will have the potential to have a negative landscape and visual impact. The proposed development addresses landscape and visual impacts on sensitive receptors. Where possible unacceptable excavated material will be reused in landscaping of the development.

Noise and Vibration

The construction of the proposed development will involve construction activities and the transportation of materials. These activities have potential to create noise and vibration impacts. Controls and mitigation have been proposed in Chapters 8 Soils and Geology and Chapter 12 Noise and Vibration to mitigate these impacts.

Air Quality and Climate

The construction of the proposed development will involve construction activities and the transportation of materials. These activities will have the potential to create air quality impacts for the surrounding receptors. Controls and mitigation have been proposed in Chapters 8 Soils and Geology and Chapter 13 Air Quality and Climate to mitigate these impacts.

Archaeological and Cultural Heritage

During the construction phase and as soil is disturbed, there is the potential to discover previously un-recorded archaeological and cultural heritage artefacts. As a result, a qualified archaeologist will be presented during construction works to identify and resolve any previously undiscovered sites of archaeological potential, both terrestrial and underwater.

17.4.5 Hydrogeology

Hydrogeology will interact and / or interrelate with the following:

Population and Human Health

The potential risk of pollution to groundwater from routine run-off and a spillage event has the potential to contaminate the ground water. The drainage system incorporates a treatment prior to discharge to minimise the potential for pollution. Furthermore, construction best practice guidelines will be followed to reduce the risk of spillage events and the contamination of groundwater. Therefore, when considered in conjunction with the overburden to the aquifer, there is a negligible risk of groundwater contamination.

Hydrology

Potential changes to aquifers or unsaturated zones may result in changes to existing baseflow to watercourses within the Study Area. The proposed development represents a negligible impact on the saturation zone of the aquifer recharge area.

Material Assets

The potential risk of pollution to groundwater from routine run-off would have a resultant impact on water quality and therefore material assets. The drainage system incorporates treatment prior to discharge to minimise the potential for pollution. Therefore, in conjunction with the overburden to the aquifer, there is a very slight risk of groundwater pollution impacting material assets.

17.4.6 Hydrology

Hydrology will interact and / or interrelate with the following:

Population and Human Health

The proposed development has been designed to avoid the potential for impeding the flood flow of the River Suir through the sequencing of construction works and minimising the width of bridge piers.

Biodiversity

During construction, activities pose a risk to watercourses, particularly as contaminated surface water runoff enter nearby watercourses. The outline Environmental Operating Plan (EOP) sets out measures to avoid the runoff of contaminants during construction. Therefore, pollution events of the River Suir which would have the potential to impact on the ecology, are considered unlikely during the construction phase.

During operation, drainage outfalling from the development to the River Suir could potentially negatively impact on the receiving water quality, causing disruption to aquatic ecology. The proposed drainage system has been designed to avoid or minimise the water quality impact to the River Suir by means of appropriate treatment prior to discharge.

Soils and Geology

During the construction earthworks, heavy rainfall events have the potential for run-off to impact on the usability of materials stored onsite. This could therefore require the importation of additional material from external sources. In conjunction with this, the run-off from the site would have the potential to increase the sediment loading to the adjacent watercourses. The draft Environmental Operating Plan (EOP) has been developed which sets out measures to avoid the silt laden runoff from contaminating the receiving watercourses.

Material Assets

During construction there may be temporary impaired drainage prior to reinstatement of such drainage works. In cases where impeded drainage during construction will cause obvious difficulty, temporary measures will be looked at on a site specific basis.

17.4.7 Landscape and Visual

Landscape and Visual will interact and / or interrelate with the following:

Population and Human Health

The visual receptor, as described in the Landscape and Visual EIAR Chapter 11, is the population, and therefore all the impacts described in the visual impact section of the EIAR relate directly to the changes to views experienced by residents, those working in the area and users of the development. Mitigation measures have been incorporated into the design to reduce impacts on properties as detailed in Chapter 11 Landscape and Visual.

Architectural Heritage

The reduction in vehicular traffic in Waterford City will have a positive impact on the setting of architectural heritage in the area. The paving and steps proposed at the South Quay Plaza will provide an improved setting for the Clock Tower.

Material Assets

During construction, the proposed development site may have an impact on material assets by discouraging tourists from visiting the area. However, during operation, landscape mitigation measures will enhance, rather than detract from, material assets and will attract visitors to the area.

17.4.8 Noise and Vibration

Noise and Vibration will interact and / or interrelate with the following:

Population and Human Health

The sensitive receptor, as described in the Noise and Vibration EIAR Chapter 12, is the population, and therefore all noise and vibration impacts relate directly to the residents, those working in the area, visitors and users of the development. Mitigation measures have been incorporated into the design to reduce such impacts on sensitive receptors.

Material Assets

The activity of earth moving machinery, transport lorries and other ancillary vehicles will generate additional noise emissions in the immediate vicinity of the proposed development construction. Noise can be of significance for sensitive receptors during both the operation and construction phases. Measures to mitigate noise impacts on sensitive receptors include good communication between the contractor and adjacent business owners and residents during the construction phase. This is particularly pertinent when excessively loud activities are programmed in order to prevent undue disturbance during construction.

17.4.9 Air Quality and Climate

Air Quality and Climate will interact and / or interrelate with the following:

Population and Human Health

A key objective of this assessment is the consideration of potential for human health impacts related to airborne emissions from the construction and operational phase of the proposed development. Accordingly, a sufficiently detailed assessment (as presented within Chapter 13 Air Quality & Climate of this EIAR) has been undertaken to estimate pollutant concentrations (i.e. Nitrogen Dioxide (NO_2) and fine particulates (PM_{10} & $PM_{2.5}$)) at specific locations that could change as a result of the scheme. These concentrations were then compared with air quality criteria set with the aim of avoiding, preventing and reducing harmful effects on human health.

Biodiversity

As well as impacts on human health, some air pollutants also have potential to impact on the surrounding biodiversity. Concentrations of pollutants in air and deposition of particles can impact biodiversity directly or affect plant health and productivity. Deposition of pollutants to the ground and vegetation can alter the characteristics of the soil, affecting the pH and nitrogen availability that can then affect plant health, productivity and species composition. Increased greenhouse gas emissions on a global scale can affect the climate, such that the ability of existing species to tolerate local conditions can change. Accordingly, a sufficiently detailed assessment (as presented within Chapter 13 Air Quality and Climate of this EIAR) has been undertaken to estimate pollutant concentrations (i.e. Oxides of Nitrogen (NO_x)) at ecologically designated sites that could change as a result of the scheme. These concentrations were then compared with the vegetation criterion for NOx and the critical load levels for Nitrogen Deposition, as reported in the Air Quality and Climate chapter.

Material Assets

Dust generated from the construction activities may cause annoyance or nuisance to business owners which may reduce productivity and numbers of tourists and visitors.

Measures to control the production of dust will be put in place by the contractor. Good communication between the contractor and business owners in the proximity of construction activities will facilitate on-going operations.

17.4.10 Archaeological and Cultural Heritage

Archaeological and Cultural Heritage will interact and/or interrelate with the following:

Population and Human Health

During operation, the redistribution of traffic will reduce the volumes of vehicular traffic through Waterford City centre, enhancing the amenity, setting and access to the archaeological and cultural heritage sites within Waterford City, improving the experience for visitors to these sites.

17.4.11 Architectural Heritage

Architectural Heritage will interact and/or interrelate with the following:

Population and Human Health

The redistribution of vehicular traffic and the focus on sustainable modes of transport resulting from the construction of the proposed development will enhance the amenity, setting and access to the architectural heritage sites within Waterford City, improving the experience for visitors to these sites.

17.4.12 Material Assets

Material Assets will interact and/or interrelate with the following:

Population and Human Health

This is primarily concerned with the impact on boat owners due to the relocation of the floating jetty and the removal of 150 car parking spaces from the Clock Tower car park. Mitigation in the form of relocating the marina and the provision of alternative car parking across Waterford City, respectively, have been considered during the assessment.

17.5 Cumulative Impacts

In addition to the plans and projects listed, a number of small scale developments, including dwelling houses and extensions were identified from the wider area surrounding the River Suir Sustainable Transport Bridge.

Plans which were identified from this search are listed and discussed below.

Plans

- Waterford North Quays Strategic Development Zone Planning Scheme;
- Waterford City Development Plan 2013- 2019 (incorporates the Housing Strategy) and SEA Environmental Report for Waterford City Development Plan;
- Waterford County Development Plan 2011-2017;
- Kilkenny County Development Plan 2014-2020;
- Waterford Planning, Land Use and Transportation Study (PLUTS) (2004);
- Economic Strategy for Waterford City and County (2013);
- Waterford North Quays - Urban Design Framework Plan (2008);

- Ferrybank-Belview Local Area Plan 2017;
- One Waterford: Local Economic & Community Plan 2015-2020;
- Report of the Waterford Re-Organisation Implementation Group and Economic Strategy for Waterford City and County, One Waterford – Delivering Jobs, Efficiency and Growth (2013);
- Waterford City & County Council Corporate Plan 2014-2019;
- Waterford City Retail Strategy (2012);
- Waterford Climate Change Strategy (2011);
- Waterford Kilkenny Advisory Regional Strategic Plan 2015-2020;
- Strategic Plan 2014-2017 Waterford – Active People, Active Place;
- Waterford City Centre Urban Renewal Scheme (2015);
- Kilkenny City and Environs Development Plan 2014-2020 – Appendix A Retail strategy;
- Fisheries Local Action Group (FLAG) Local Development Strategy 2016;
- Waterford Children & Young People's Services Committee Children & Young People's Plan 2015-2018;
- Regional Planning Guidelines for the South East Region 2010-2022;
- Regional Spatial and Economic Strategies;
- River Basin Management Plans and Programme of Measures (2nd Cycle in preparation Department of Communications, Climate Action and Environment);
- Catchment Flood Risk Assessment and Management (2011);
- Draft Flood Risk Catchment Management Plans for the South East;
- South East Region Employment Action Plan 2011;
- Southern Regional Waste Management Plan 2015-2021;
- River Basin Management Plan 2018-2021;
- Southern and Eastern Regional Operational Programme 2014-2020; and
- South East Economic Development Strategy (SEEDS) 2013-2023.

17.5.1 Waterford North Quays Strategic Development Zone

The North Quays Strategic Development Zone (SDZ) Planning Scheme was adopted by Waterford City and County Council in February 2018. The Planning Scheme sets out a Vision to include:

- *"To create a sustainable, compact extension to the City Centre that will serve a future population of 83,000 people*
- *A regeneration catalyst for the City and Region and the establishment of a sustainable modern city quarter.*
- *Creation of an integrated multi-modal transport hub designed to sustainably meet the access requirements of The City.*
- *Building on the context and the riverside location of the site to create a high quality urban quarter as a natural extension of the City Centre."*

It also has as a Principal Goal:

> *"To link the north and south side of the city by providing a new sustainable transport bridge crossing and improve accessibility and connectivity by creating an environment that facilitates internal pedestrian and cycle movements."*

The proposed development is consistent with the Planning Scheme and will support the future development and social integration with the NQ SDZ Planning Scheme that includes the development of a new urban quarter with commercial, residential developments, a transport hub and tourism infrastructure that will be connected via the proposed development to the existing city centre urban core.

Furthermore, the proposed development is likely to have significant positive long-term cumulative effects due to increased economic activity as a result of the proposed development and future developments associated with the NQ SDZ. Therefore, it is predicted that there will be positive cumulative impacts as a result of the proposed development and the NQ SDZ Planning Scheme. The proximity to the Lower River Suir SAC is a key concern in the development of the SDZ and any future applications to develop the SDZ lands are required required to strictly adhere to the mitigation measures proposed in the Waterford North Quads SDZ Natura Impact Report and Strategic Environmental Assessment to ensure the avoidance of adverse effects on the SAC.

17.5.2 Waterford City Development Plan 2013-2019 and SEA Environmental Report for Waterford City Development Plan

The Waterford City Development Plan 2013-2019 sets out an overall strategy for the proper planning and sustainable development of the functional area of Waterford City. 4,800 units of housing (240 ha) is required for the plan period. The Plan requires housing to be located as close as possible to employment opportunities and public transport routes and that are readily accessible to the City Centre. Waterford City Development Plan 2013-2019 supports the development of the proposed Sustainable Transport Bridge. The South Quays lie within an Architectural Conservation Area (ACA) and Trinity Within ACA. These areas are "*designated as being the subject of a future urban design framework*" which would address, among other issues:

- Roads and links, both internally and from the city centre;
- New sustainable transport bridge;
- New development and infrastructure; and,
- Traffic and movement, parking.

As the proposed development supports the Waterford City Development Plan, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.3 Waterford County Development Plan 2011-2017

The Waterford County Development Plan 2011-2017 sets out the overall strategy for the proper planning and sustainable development of the County for the period 2011-2017. Key strategic sites supporting and fostering entrepreneurship are promoted. The proposed development supports the Waterford County Development Plan and it is therefore considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.4 Kilkenny County Development Plan 2014-2020

This Development Plan sets out Kilkenny County Council's policies and objectives for the proper planning and sustainable development of the County from 2014 to 2020. The proposed development will assist with allowing the sustainable development objectives of the Plan to be realised by encouraging sustainable modes of transport. The proposed development will also allow South Kilkenny to grow by connecting the region with Waterford City centre. As the proposed development supports the Kilkenny County Development Plan, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.5 Waterford Planning, Land Use and Transportation Study (PLUTS) (2004)

The Waterford Planning, Land Use and Transportation Study (PLUTS) (2004) recognises the potential of the North Quays as an extension of the city centre and prioritises a new city centre sustainable transport bridge and a new public transport interchange at North Quay. Key recommendations of the PLUTS include:

- A new city centre bridge for pedestrians and cyclists which will link the redeveloped North Quays with the existing City Centre;
- Provision of a rail-passenger platform on the North Quays as part of a new Public Transport Interchange; and,
- A future third bridge crossing downstream on the River Suir which would complete the loop around the system connecting the N25 Bypass, the River Suir Bridge and the Outer Ring Road. The PLUTS is an integrated framework of plans and solutions to address the needs of the City in both land use and transportation terms up to the year 2020. The study aims to achieve a more balanced growth between north and south sides of the River Suir, incorporating a new City Centre Bridge for pedestrians and cyclists and the provision of a rail passenger platform on the North Quays.

The proposed development will satisfy the proposals outlined in the PLUTS by providing a bridge for pedestrians and cyclists, easing and improving accessibility between the city centre and the future redevelopment of the North Quays through an additional river crossing. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.6 Economic Strategy for Waterford City and County (2013)

The strategy includes a number of proposals for Waterford City redevelopment of the North Quarter and waterfront. Key long term economic objectives (2018) outlined in the report include:

- Assess the roles of South and North Quays and to better connect with the waterfront. Agree demolition of much of North Quays silos and develop an amenity area, open up stretches of South Quays, less parking and more defined zones of different activity.
- Potential for a self-contained river-side village – south-facing and often sheltered from the prevailing winds. Waterside restaurants, festival shopping, boutique hotels, apartments, offices, ateliers and galleries beside a riverside boardwalk. Scope for development (probably residential and hotel-led) that benefits from the
- south facing aspect and views to the core city centre. Look to upgrade and diversify the existing hotel offer in Waterford City to provide more variety and higher quality service and experience. For example, long term serviced apartments (whether for corporate lets or holiday lets), a genuine boutique

hotel and perhaps an international brand to benefit from their marketing databases.

The strategy aims to identify measures to maximise the economic development of Waterford and its wider hinterland/region and, in particular, to enhance the role of Waterford City as a generator of growth and a strong and dynamic focus for development of the wider region. The proposed River Suir Sustainable Transport Bridge will assist the economic strategy reach its objectives by improving connectivity of Waterford City with residential areas in South Kilkenny and with the proposed North Quays Strategic Development Zone. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.7 Waterford North Quays – Urban Design Framework Plan (2008)

The Urban Design Framework Plan for the North Quays presents a broad vision for the North Quays, providing basic development concepts and key urban design guidelines, bringing together an integrated framework plan for the area. The Plan outlines the need for more balanced growth between north and south sides of the River Suir, a new city centre pedestrian and cycle bridge, the provision of a rail platform on the North Quays and the development of a mix of uses on the site. The proposed development is a key enabler of the Waterford North Quays Urban Design Framework Plan and the proposed expansion of the City Centre. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.8 Ferrybank – Belview Local Area Plan 2017

The Ferrybank- Belview Local Area Plan (LAP) 2017 outlines a strategy for the proper planning and sustainable development of an area of land stretching from Grannagh to Belview and from the River Suir to the line of the Waterford bypass, adjacent to the SDZ. The policies, objectives and zoning objectives for existing and future development of the Ferrybank area have been considered as part of the Planning Scheme proposals. The LAP re-emphasises the PLUTS requirement for a "*new city centre bridge for pedestrians and cyclists which will link the redeveloped North Quays with the existing City Centre*". The Plan also highlights that the Ferrybank/Belview area is in close proximity to Waterford City which "*means that many opportunities exist for the promotion of walking, cycling and public transport".* Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.9 One Waterford: Local Economic & Community Plan 2015-2020

The Plan identifies and delivers positive step changes that will deliver the economic and social transformation of Waterford, to grow the local and regional economy, strengthen Waterford's role as the regional leader of the South East, ensure that our communities are strong and engaged, and ensure that all people have an excellent quality of life. An objective of the Plan is to revitalise, regenerate and improve the urban environment, including realising the economic potential of the North Quays by 2019. The proposed River Suir Sustainable Transport Bridge is necessary in order for these objectives to be realised. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.10 Report of the Waterford Re-Organisation Implementation Group and Economic Strategy for Waterford City and County, One Waterford – Delivering Jobs, Efficiency and Growth (2013)

The Plan outlines an Economic Strategy for Waterford City and County. The Plan determines that certain key interventions are needed to enable the sustainable growth and recovery of the economy of Waterford and the South East and addresses the inhibitors of growth. The development, improvement of public realm and commercial opportunities of the North Quays are recommended to help develop the critical mass of Waterford as a Gateway City. The proposed River Suir Sustainable Transport Bridge is necessary in order for the strategy to be realised. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.11 Waterford City and County Council Corporate Plan 2014-2019

The Corporate Plan outlines strategic priorities and objectives for the Council for its lifetime and is reflective of the needs and priorities of all the communities and citizens of Waterford. It is considered that the proposed River Suir Sustainable Transport Bridge will represent a positive cumulative impact with the Corporate Plan.

17.5.12 Waterford City Retail Strategy 2012

The Retail Strategy provides a quantitative and qualitative analysis of the potential of Waterford City to accommodate further retail development. The strategy outlines policies with the aim of meeting the City's shopping needs in a way that is efficient, equitable and sustainable. Additional convenience and comparison retail floor space is required for Waterford City. As the proposed River Suir Sustainable Transport Bridge will allow the connectivity of the proposed North Quay shopping area with Waterford City centre, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.13 Waterford Climate Change Strategy 2011

The Waterford City & County Council's Climate Change Strategy aims to implement a series of measures that will result in Green House Gas reductions. Climate change measures will be addressed under the Strategic Environmental Objectives (SEOs). As the proposed River Suir Sustainable Transport Bridge will encourage sustainable modes of transport, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.14 Waterford Kilkenny Advisory Regional Strategic Plan 2015-2020

The Teagasc Strategic Plan for the Waterford Kilkenny Advisory Region outlines ways to help farmers exploit their natural advantages and become world leaders in sustainable agricultural production. It is not expected that there will be cumulative impacts as a result of the proposed development with the Strategic Plan as the proposed River Suir Sustainable Transport Bridge is located in an urban, city centre location.

17.5.15 Strategic Plan 2014-2017 Waterford – Active People, Active Place

The Plan's objective is the development and delivery of sport and physical activity opportunities in County Waterford. As the proposed River Suir Sustainable Transport Bridge will encourage sustainable and active modes of transport including cycling and walking, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.16 Waterford City Centre Urban Renewal Scheme (2015)

The Urban Renewal Scheme outlines public realm upgrades, alterations to traffic circulation and the demolition of a number of old buildings in the hope to upgrade the urban centre. The Urban Renewal Scheme focuses on the city centre. As the proposed River Suir Sustainable Transport Bridge will encourage the continued upgrade and regeneration of Waterford City, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.17 Kilkenny City and Environs Development Plan 2014-2020 – Appendix A Retail strategy

The City and Environs Development Plan looks at the 2008 update to the Kilkenny City and County Retail Strategy and takes into account the economic changes in the city since. The 2008 update reviewed population figures and forecasts, updated floor space, household and shopper's surveys and carried out a broad capacity assessment for the requirement of additional retail floor space. Indicative floor space requirements for Kilkenny for 2020 are 1,599m^2 convenience and 16,502m^2 comparison. Ferrybank has permitted convenience floor space of 4,577m^2 and comparison floor space of 4,341m^2 yet to be developed. Waterford is identified within the strategy as the Gateway of the region. As the proposed River Suir Sustainable Transport Bridge will allow the connectivity of Waterford City Centre with the proposed North Quays shopping facilities in the SDZ, it will encourage the growth of retail in the city. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.18 Fisheries Local Action Group (FLAG) Local Development Strategy 2016

The Strategy assesses the development needs of the FLAG area, outlining objectives and actions to further develop the industry within the area. The strategy does not relate specifically to the site proposed. The nearest location included in the strategy is Cheekpoint, 4km downstream. Therefore, it is not expected that there will be significant cumulative impacts as a result of the proposed development.

17.5.19 Waterford Children & Young People's Services Committee Children & Young People's Plan 2015-2018

The Plan identifies the needs of children and young people and lays out a set of priority actions which are intended to improve service delivery and achieve better outcomes for all children in the area. It is not expected that there will be significant cumulative impacts as a result of the proposed development.

17.5.20 Regional Planning Guidelines for the South East Region 2010-2022

The Regional Planning Guidelines are intended to constitute a strategic planning framework for the period 2010-2022 for the development of each region and for interregional cooperation. The strategic policies and objectives set out in the Regional Planning Guidelines will form the backdrop for socio-economic planning by national and regional agencies and will constitute the policy framework within which county, city, town and local area development plans will be made. The Regional Planning Guidelines support the re-development of the North Quays was included as a Critical Enabling Investment Priority in the Regional Planning Guidelines in 2004. A rail passenger platform on the North Quays and a river crossing to provide a link across the river are outlined as objectives. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.21 Southern Regional Spatial and Economic Strategy

A Regional Spatial and Economic Strategy (RSES) is currently being prepared by the Southern Regional Assembly (SRA). The main statutory purpose of the RSES is to support the implementation of the draft National Planning Framework (NPF), also known as Ireland 2040 - Our Plan, and the economic policies and objectives of the Government by providing a long-term strategic planning and economic framework for the development of the three regions: Eastern & Midland; Southern; and Northern & Western. The Southern RSES will be a strategic plan which identifies regional assets, opportunities and pressures and will provide appropriate policy, objective and target responses. It will put in place policies and recommendations that will better manage regional planning and economic development throughout the region. It is not expected that there will be significant cumulative impacts as a result of the proposed development.

17.5.22 River Basin Management Plans and Programme of Measures

The River Basin Management Plans, once produced, will ensure the Rivers Suir and Barrow achieve "good" status by 2027. is not expected that there will be significant cumulative impacts as a result of the proposed development. The proposed development will not reduce the water quality of the River Suir and therefore, it is not expected that there will be significant cumulative impacts as a result of the proposed development.

17.5.23 Catchment Flood Risk Assessment and Management (2011)

The Catchment Flood Risk Assessment and Management (CFRAM) Programme was brought into place in Ireland in 2011, as a strategy for medium to long term flood risk reduction and management. The Programme is led by local authorities as well as the OPW, and it incorporates core components of the National Flood Policy (2004) and requirements of the Floods Directive. The Programme is made up of three phases as follows: The Preliminary Flood Risk Assessment (PFRA) 2011; The CFRAM Studies and parallel activities 2011-2015; Implementation and Review 2016 onwards. The outcomes thus far from the project are: Preliminary Flood Risk Assessment 2011; Flood Hazard Mapping 2014; Flood Risk Management Plans 2015. The South Eastern River Basin District CFRAM Study was the third CFRAM Study to be commissioned. The Natura Impact Statement for the proposed draft Suir Flood Risk Management Plan (FRMP) undertaken in September 2016 concluded that the FRMP will not have a significant adverse impact on the screened in European Sites of Hook Head SAC, Lower River Suir SAC and River Barrow and River Nore SAC provided the mitigation measures outlined in Chapter 6 of the NIR are adopted in the FRMP and at project stage. Elements of the plan that are likely to have impacts on Natura 2000 sites are the alteration of the North Quay Wall, artificial lighting of the North Quay, light spill onto the River Suir and disturbance associated with construction. Having regard to elements of the proposed development that are likely to result in such impacts, it is considered that, with mitigation in place, there will be no significant in-combination effects on the River Suir as a result of the proposed development.

17.5.24 Draft Flood Risk Catchment Management Plans for the South East

The objectives of the Draft Flood Risk Catchment Management Plans for the South East are to identify flood risk, to identify structural and non-structural measures and options for managing flood risk. As the proposed development will not increase the flood risk for the area, it is not expected that there will be significant cumulative impacts as a result of the proposed development.

17.5.25 South East Region Employment Action Plan 2011

The Plan revisits the Regional Competitiveness Agendas for the South East region, taking account of recent developments and analysis, and outlines specific actions that can be taken to maximise employment creation in the region in the short and medium-long-term. It promotes Waterford as a gateway, taking action to maximise employment creation. The proposed River Suir Sustainable Transport Bridge will increase visitor numbers to the area and will therefore indirectly promote employment creation. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.26 Southern Regional Waste Management Plan 2015-2021

The Plan is a guide to help us manage our wastes in a safe and compliant manner, through policies and actions. It provides policy direction in a broad manner, setting out what we want to achieve and a roadmap of actions to get us there. The proposed development will comply with best practice guidelines for managing waste produced by the development. Therefore, it is not expected that there will be significant cumulative impacts as a result of the proposed development.

17.5.27 River Basin Management Plan 2018-2021

The River Basin Management Plan 2018-2021 aims to protect all waters within the district and where necessary, improve waters and achieve sustainable water use. The SEOs have included an objective to maintain the water quality standards in the South East River Basin Management Plan. The proposed development will not reduce the water quality of the River Suir and therefore, it is not expected that there will be significant cumulative impacts as a result of the proposed development.

17.5.28 Southern and Eastern Regional Operational Programme 2014-2020

The Southern and Eastern Regional Operational Programme 2014-2020 is intended to support and facilitate Member States and Managing Authorities in the implementation of the partnership principle. A priority objective is to revitalise, regenerate and improve the urban environment in the designated urban centres as part of integrated urban strategies. Waterford Gateway was awarded funding in 2014 through the Designated Urban Centres Grant Scheme 2014-2020, with aims to regenerate substantial brownfield sites in the city centre, while improving accessible public realm and transport modes. The proposed development supports the Programme as it will improve accessibility, promotes sustainable mobility and will regenerate the surrounding area. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

17.5.29 South East Economic Development Strategy (SEEDS) 2013-2023

The SEEDS aims to identify the economic needs of the South East, with the objective of considering what steps can be taken to improve the employment situation, examining the region's particular circumstances and making specific proposals to create jobs and grow the regional economy. The proposed development will enhance economic development within the Southeast region, providing connectivity and access between Waterford City centre and the proposed transport hub that is proposed as part of the North Quays SDZ. This will aid the development of the North Quays as a Key Strategic Site, which will provide employment through mixed use developments. Therefore, it is considered that there will be positive cumulative impacts as a result of the proposed development.

Projects which were identified from this search are listed and discussed below.

Projects

- River Suir Sustainable Transport Bridge Ground Investigations;
- Newgate Properties Ltd.;
- Waterford-New Ross Greenway;
- ESB 110KV Station;
- Kilkenny and Carlow Education and Training Board;
- CHI Environmental;
- Waterford Flood Alleviation Scheme Phase 1;
- Waterford Greenway Cycle and Pedestrian Route - Kilmeaden to Bilberry;
- Stafford Bonded Warehousing Ltd;
- Uptown Property Development Ltd – Industrial Unit;
- Roadstone Ltd;
- Seed Technology Ltd;
- Glanbia Ingredients Ireland DAC;
- Target Fertilisers Ltd.;
- Glanway Ltd.;
- Highfield Solar Ltd.;
- Kent Quarries Ltd.;
- Abbey Community College Extension
- Dredging;
- Demolition of former R&H Grain Store;
- Waterford City Public Infrastructure Project: Rock Stabilisation and Rock Protection Works Part VIII Application;
- Waterford City Public Infrastructure Project SDZ Access and Public Road Infrastructure Part VIII Application;
- WCCC Transportation Hub: Dock Road & NQ SDZ Application;
- WCCC Flood Defence Project; and
- Residential Units

17.5.30 River Suir Sustainable Transport Bridge Ground Investigations

Ground Investigations were undertaken in 2017 within the proposed development location to inform the bridge design. Appropriate Assessment (AA) screening was carried out for the works to assess the potential impacts of the investigation works on the Lower River Suir SAC. No likely significant cumulative impacts are predicted due to the GI works which were completed in 2017.

17.5.31 Newgate Properties Ltd. [Planning Ref.: 16175]

Permission was granted for the proposed development by Newgate Properties. The project is to include (i) a shopping centre principally bounded by Alexander St to the north; Michael St to the east; Stephen's St to the west and New St to the south, and (ii) a multi-storey car park accommodating 385 spaces on four levels, linked to the shopping centre by a glazed pedestrian bridge and (iii) demolition works. The shopping centre will have a total gross floor area of 10,030 sqm and cafe/ restaurants will have gross floor area of 635 sq.m. An EIS was submitted with the application and permission was granted in February 2017 subject to conditions following appeal by a third party. The decision found that the scheme would not have unacceptable adverse effects on the environment. The proposal by Newgate Properties is situated 400m from the proposed River Suir Sustainable Transport Bridge.

Due to the highly developed nature of the area and the conclusion of the EIS submitted with the application, cumulative effects are not expected to occur as a result of the Newgate Properties development and the proposed Sustainable Transport Bridge.

17.5.32 Waterford – New Ross (Kilkenny) Greenway

The proposed development comprises of the disused railway line on lands which extend from within Waterford City and County Council's administrative boundary through to Rosbercon, New Ross as a cycle and pedestrian route. The route which is 22km in length will begin at Abbey Road, Ferrybank, Waterford and will follow the disused line through or in close proximity to the townlands of Abbeylands, Rathculliheen, Gorteens, Drumdowney Lower, Rathpatrick, Luffany, Curraghmore, Ballyrowragh, Scartnamoe, Rathinure, Rochestown, Aylwardstown, Carrickcloney, Ballyverneen, Forestalstown, Shanbogh Upper and Raheen (Rosbercon), Co. Kilkenny. Positive cumulative impacts are predicted as the proposed Waterford to New Ross Greenway will connect with the existing Waterford Greenway by utilising the proposed sustainable transport bridge.

The development received Part 8 planning in 2018. An EIA Screening, EcIA and AA Screening were submitted with the Part 8 for the Greenway, concluding that no significant impacts will occur to the protected sites as a result of the development. It is expected that there will be positive cumulative impacts as a result of the proposed development and the Waterford to New Ross Greenway. The potential to connect the Waterford to New Ross line with the South Quays will improve connectivity in the area, having positive impacts for the local area.

17.5.33 ESB 110KV Station [Planning Ref.: 16768]

The development consists of alterations to the existing 110KV station consisting of one 38KV MV module, one MV GIS module, one house transformer, 2 no. cable chairs, new internal gates in existing fence, associated drainage and site works at the ESB Waterford 110 kV station at Gracedieu Road. The site is located 950m upstream of the proposed footbridge on the south side of the River Suir. Planning permission was granted in January 2017 (Planning Reference: 16768). An AA Screening determined that there are no likely significant cumulative impacts expected due to the development of the ESB station. No cumulative impacts are perceived as a result of the proposed development.

Permission was granted in 2017 for the ESB development consisting of alterations to the existing 110KV station consisting of one 38KV MV module, one MV GIS module, one house transformer, 2 no. cable chairs, new internal gates in existing fence, associated drainage and site works. ESB Waterford 110 kV station at Gracedieu Road, Waterford, 900m upstream of the proposed development, on the south side of the River Suir. Due to the distance from the proposed River Suir Sustainable Transport Bridge and the lack of a pathway, no likely significant cumulative impacts are predicted.

17.5.34 CHI Environmental [Planning Ref.: 15647]

Planning permission was granted in 2016 for change of use of existing industrial site and buildings, formerly used as an aluminium paint manufacturing facility, to a materials recovery and transfer facility and civic amenity centre, alterations to the external elevations of buildings and all associated site works. An Environment Impact Statement and Appropriate Assessment (Stage 1) were submitted with the application and therefore no likely significant cumulative impacts are predicted.

17.5.35 Waterford Flood Alleviation Scheme Phase 1

Flood protection works were completed in 2014 along the River Suir upstream at its confluence with John's River at Scotch's Quay/George's Quay along the length of the South Quay to Rice Bridge and on John's River from its confluence with the River Suir at Scotch Quay/ George's Quay. The flood protection works are in immediate proximity to the proposed development. As the flood protection works were subject to the relevant environmental and ecological assessments at the planning stage, no likely significant cumulative impacts are predicted.

17.5.36 Waterford Greenway Cycle and Pedestrian Route – Kilmeaden to Bilberry

A 9.6km Greenway between Kilmeaden and Bilberry, Waterford, 600 m upstream of the proposed development, on the south side of the River Suir, is open to the public. The route forms part of the Waterford to Dungarvan "Déise Greenway". Due to the distance from the proposed River Suir Sustainable Transport Bridge, no likely significant cumulative impacts are predicted.

17.5.37 Stafford Bonded Warehousing Ltd [Planning Ref.: 1624]

Permission was granted in 2016 to Stafford Wholesale Ltd. for the erection of a 11.2m high approximately twin portal industrial warehouse unit (approximately 1,984m^2 floor area) for the bonded storage of spirits with associated office, canteen and toilet facilities, parking, external lighting, boundary fencing and associated site development works was granted in April 2016. The site is located approx 10km south of the proposed River Suir Sustainable Transport Bridge. Due to the distance from the proposed River Suir Sustainable Transport Bridge, no likely significant cumulative impacts are predicted.

17.5.38 Uptown Property Developments Ltd. [Planning Ref: 16392]

A ten-year planning permission was granted in September 2016 for 6 no. light industrial/warehouse units comprising of ground floor storage, office, canteen, reception, toilets, together with storage area on mezzanine level and associated external signage, 3 no. pavement area for external storage and associated boundary treatments; two no. vehicular access points, car-parking, access roads, landscaping and boundary treatment and all other associated site works. The proposed development is located in Waterford Airport Business Park, Kilowen, approximately 9km south east of the proposed River Suir Sustainable Transport Bridge. An AA Screening was carried out for the proposed development which found there to be no significant adverse impacts anticipated. Due to this in combination with the conclusion of the NIS and EIAR for the proposed River Suir Sustainable Transport Bridge and the considerable distance between the two sites, no cumulative impacts are expected as a result of the proposed development.

17.5.39 Roadstone Ltd. [Planning Ref.: 16700]

Permission was granted in March 2017 to Roadstone Ltd for the continuation of quarrying activities and to include the extension of the existing excavation by an additional 2 x 15m high benches from the current floor level of ca.-15m AOD to -45 m AOD within the permitted extraction footprint area of 27.06 ha. The proposed development will involve the continuation of stripping of overburden and its storage for use in site restoration; the extraction of rock by means of blasting, the crushing of blasted rock on the quarry floor, and subsequent processing of crushed rock in the existing aggregate plant to produce a range of aggregates. The proposed development will also include the continuation of use of the existing wheel-wash and associated hardstanding area, bunded fuel tank and associated refuelling area. An Environmental Impact Statement (EIS) and Natura Impact Statement (NIS) were submitted to the Planning Authority with the planning application. These stated that no adverse impacts are expected on the environment including the Lower River Suir SAC. Due to the considerable distance of 5.5km between the sites, and the conclusion of the environmental assessments and the Appropriate Assessment (AA) from both projects, no cumulative impacts are expected.

17.5.40 Seed Technology Ltd. [Planning Ref.: 15397]

Permission was granted in 2015 to Seed Technology Ltd. for a seed processing and storage building (4,836m^2), fertilizer bagging and storage building (6,094m^2), 2 No. external dust extraction silos, single storey office building and car parking (156m^2), weighbridge, external fertilizer pallet storage yard, 4No. external fire-water storage tanks, storm water attenuation pond, on site borewell and associated pump house, wastewater treatment system and percolation area, extension of existing site access road, infilling of low lying portion of site with excavated material from the development, signage, boundary fencing and landscaping together with all associated site development works. No AA or EIA was required, however conditions were attached by the Local Authority to provide further protection of the environment. Due to the distance of 4.9km between the proposed development and the processing and storage building, and the likelihood of having no significant effects, no cumulative impacts are expected as a result of the proposed River Suir Sustainable Transport Bridge.

17.5.41 Glanbia Ingredients Ireland DAC [Planning Ref.: 17153 & 1777]

Two planning permission applications were granted to Glanbia Ingredients Ireland DAC in 2017. Permission was granted in June 2017 for extensions to an existing dairy processing facility (Planning Ref: 17153). The proposed extensions will incorporate a new Warehouse, five storey Production Building, Evaporator Building, Wet Process, extension to the Utility Building, New Boiler Building (with new exhaust stack 45m), new Dairy Intake Building, single storey extension to the Sprinkler Building, as well as some additional other items of external plant and machinery, pipe bridges, ingredient silos and refrigeration plant. The proposed extensions also includes landscaping, internal road changes with lighting and ancillary external works. The total new building area is approx. 12,043sqm. An Environment Impact Statement and a Natura Impact Statement was submitted to the planning authority with the application. Permission was granted subject to conditions including the provision of a Construction Environmental Management Plan and Waste Management Plan. No cumulative impacts are expected as a result of the proposed River Suir Sustainable Transport Bridge.

The second planning permission (Planning Ref: 1777) was for an extension to the existing milk powder processing plant, extensions to the existing Administration Building to accommodate an enlarged food preparation area, additional personnel facilities, offices and a laboratory. The development will also include alterations to existing roads, car parks, drainage system, services and landscaped areas, a new 97 space car park, truck loading and unloading bays, paved areas and all associated drains and services including site lighting and landscaping works. The proposed extension is located in IDA Science & Technology Park, Gorteens, 4km east of the proposed development. No cumulative impacts are expected as a result of the proposed River Suir Sustainable Transport Bridge.

17.5.42 Target Fertilisers Ltd. [Planning Ref: 1646]

Target Fertilisers Ltd were granted permission for the proposed erection of an Industrial Warehouse Building for the storage and bagging of fertiliser products superseding a previous Application for a similar building on this site which was Granted Permission under Planning Reg No.15/263. The permission also includes alterations to site boundaries including new boundary wall and fencing and all associated site works and ancillary services. The proposed warehouse location is approximately 4km east of the proposed River Suir Sustainable Transport Bridge. Therefore, due to the distance between the projects, no cumulative impacts are expected as a result of the proposed River Suir Sustainable Transport Bridge.

17.5.43 Glanway Ltd. [Planning Ref.: 1591]

Permission for an extension of use including additional processing and an increase in throughput up to 95,000 tonnes per annum of municipal waste material at the waste facility. Permission was also sought for a prefabricated building with an office, canteen and toilet; alterations to site works and retention of existing doors on the north elevation of Store No.5 (P11/397) and on the east elevation of Store No.6 (P13/585). The Application was accompanied by an Environmental Impact Statement, Further Information and a Habitats Directive assessment which concluded that no adverse impacts would occur as a result of the proposed development. The site is located at Belview Port, 4km east and on review of the EIAs and NISs for both developments, no cumulative impacts are expected as a result of the proposed River Suir Sustainable Transport Bridge and the additional processing at Glanway Ltd.

17.5.44 Kent Quarries Ltd. [Planning Ref.: 15366]

Permission was sought within part of an existing quarry for a recycling facility for the recycling of construction and demolition waste and for the importation and recovery of non-hazardous soils, subsoil and other similar material. Material will be crushed and screened using existing mobile quarry plant and machinery and non hazardous soils will be used in the existing rehabilitation scheme for the quarry. The planning application was accompanied by a Natura Impact Statement and an Environmental Impact Statement. The application was appealed to An Bord Pleanála and was granted permission by the Board in March 2017 with 8 no. conditions. The quarry is located approximately 8.3km north of the proposed River Suir Sustainable Transport Bridge and due to this considerable distance and the results of both of the AA and EIS, no cumulative impacts are expected.

17.5.45 Abbey Community College Extension

Permission for the construction of 3,240m^2 standalone 2-storey extension to existing school, provision of new staff & visitors carpark, reorientation of existing grit pitch, alterations to the existing school building, provision of new on-site bus and car set down facilities, new paved external social space, works to existing site entrance and all associated site works. This application is part of a joint application with Kilkenny County Council (with part of the proposed development located in County Kilkenny). A separate application is being made in parallel to both planning authorities for the relevant section of development in their area. Proposed works located within Waterford City are as follows: Alterations to existing entrance to provide new filter lane, provision of new kerbing to delineate access to site, demolition and reinstatement of front boundary wall and entrance piers to facilitate sight lines, provision of new entrance gates, provision of additional new on site bus and car set down facilities and all associated site works. The college extension is located approximately 550m east of the proposed development. As there is no pathway between the projects, no likely significant cumulative impacts are expected due to the construction and operation of the extension.

17.5.46 Dredging

An application was made for the disposal of a maximum of 18,200 tonnes of dredge material (consisting of sands, silts & mud) from maintenance dredging from the Waterford City Marinas along the South Quays in Waterford. The application involved the disposal of dredged material 2.3km west of Hook Head. This application was made to facilitate Tall Ships Race on 30th June 2011. A permit was granted with conditions by the Environmental Protection Agency (EPA) for the dumping at sea of dredged material arising from maintenance dredging by Port of Waterford Company at a number of discrete locations in the Suir Estuary/ Waterford Harbour over an eight-year timeframe (2014-2021). A Natura Impact Statement was submitted as part of the permit application. On 20th February 2018 the Port of Waterford gave notice to the EPA under condition 2.5 of the permit to commence maintenance dredging with a trailer suction hopper dredger to start on 20th March 2018 for approximately 25 days. The latest dredging activity which was notified to the EPA was carried out in March 2018 under this application.

The Port of Waterford's current 8 years Dumping at Sea Permit runs until 2021 (ref: S0012-02). However, after consultation with the EPA regarding amendments to the current practices and allowable tonnages, a new application needs to be submitted to ensure the proposed amendments are appropriately assessed and considered.

An application was made in December 2017 for the dredging of accumulated sediments to maintain navigation areas 2.5km south west of Hook Head in the River Suir and Waterford Estuary.

As all dredging works are subject to the required environmental assessments and EPA licence, no likely significant cumulative impacts are expected due to the proposed development.

17.5.47 Demolition of Former R&H Grain Store

The nine storey, reinforced concrete former R&H grain store on the North Quays in Waterford City was demolished in July 2018. The demolition works were carried out to facilitate the future redevelopment of the Waterford North Quays. The demolition works were subject to the required environmental assessments and no likely significant cumulative impacts are expected due to the demolition of the grain store.

17.5.48 Waterford City Public Infrastructure Project: Rock Stabilisation and Rock Protection Works Part VIII Application

The rockface running parallel to the railway line behind Plunkett station requires works to reduce the risk of global slope instability and of rockfalls which could affect railway infrastructure, Irish Rail personnel or the public. The project comprises of approximately 380 metres of rockface remedial works consisting of a combination of rock face stabilisation measures (rock bolting and netting) and rock fall protection systems (metal rockfall barriers fixed to the rockface or rockfall strengthened earth embankments). Other works which are anticipated to be required to facilitate the construction include the temporary removal of the existing signal cabin adjacent to the rockface (to be reinstated following the works), construction of a temporary access embankment from imported & site won material in front of sections of the rockface to enable rockface reprofiling, installation of a cut off drain at the top of the rockface and its connection into the existing station drainage network, excavation of existing rockfall debris at the place of the proposed rockfall embankment and de-vegetation of the rock face where required.

There are no significant effects predicted to arise from the combination of the proposed cliff works with the Project.

17.5.49 Waterford City Public Infrastructure Project SDZ Access and Public Road Infrastructure Part VIII Application

The proposed road and access infrastructure will consist of modifying and upgrading the existing R711 dual carriageway and Abbey Road to facilitate the connection of the existing and proposed future planned road, cycling and pedestrian network with a future planned internal road, cycle and pedestrian network within the NQ SDZ.

Connection into the SDZ is proposed through two bridge access points located at the eastern and western ends of the SDZ respectively. The eastern access will connect into a realigned Abbey Road and the western access will connect to the R711 opposite the currently unoccupied 'Ard Rí Hotel' entrance. The site is set back from the existing Dock Road and adjacent properties and is also set back from the River Suir.

There are no significant effects predicted to arise from the combination of the proposed road infrastructure with the Project.

17.5.50 WCCC Transportation Hub: Dock Road & NQ SDZ Application

Construction of a new transport hub to accommodate the relocation of the existing passenger terminus from Plunkett train station. The project has not yet been fully defined or designed at this stage. However, the site is defined and the works are likely to comprise of the following; site clearance (including the demolition of the existing railway overbridge at the site); Two number 200m long station platforms; A train station building at the eastern end of the platform which will comprise of a concourse/waiting Area and a footbridge/ plaza bridge over the railway line connecting into the SDZ development; A footbridge at the western end of the platforms connecting into the SDZ development; Hard landscaping of the area between the Project (access infrastructure) drop-off/ set-down area and the station/platforms to facilitate safe access and egress into the station and NQ SDZ. The site is set back from the existing Dock Road and adjacent properties and is also set back from the River Suir.

There are no significant effects predicted to arise from the combination of the proposed transportation hub with the Project.

17.5.51 WCCC Flood Defences Project

The aim of this future project is to provide flood protection to the west of Rice Bridge. This project will be developed between Irish Rail, the Office of Public Works and Waterford City and County Council and is currently at preliminary discussion stage. In the absence of any design or even design options, an assessment of cumulative effects with this project cannot be undertaken at this stage. Once developed, this project will be required to undertake the appropriate assessments including EIA

Screening and AA Screening and consider the cumulative effects resulting from all other projects as appropriate.

An assessment of cumulative effects with this project without detail on location, scale and design is not feasible at this stage and is not included as part of this assessment.

17.5.52 Residential Units

Planning applications have been submitted for a number of residential developments within the Waterford area from 2008 to 2018. The largest of these proposed residential developments include the following:

Sisters of the Sacred Heart of Mary

Planning permission for the construction of a Sheltered Residential Care Home for the Sisters of the Sacred Heart of Mary was granted in January 2018. Accommodation will consist of 8 no.1 bedroom independent living units, communal living accommodation, oratory and all associated ancillary accommodation in 2 no. single storey blocks. All of the above works will be undertaken with new site car parking, alterations to internal site road access and all associated site works. The proposed care home will be located on Abbey Road, 700m east of the proposed River Suir Sustainable Transport Bridge. The planning authority sets out requirements which must be followed by the developer to ensure best practicable means are implemented to prevent and minimise impacts due to surface water run-off during construction and operation of the development. Therefore, no likely significant cumulative impacts are expected due to the construction and operation of the care home.

McInerney Homes Ltd. – Housing Development (Planning Ref: 14500067)

Extension of the duration of a previous planning permission under planning ref: 09/500006 was granted in July 2014 and will be valid until May 2019. The development consists of the construction of 22 no. semi detached homes to replace 18 no. detached houses on site numbers 58 - 75 granted under Planning Permission No. 04/500131, minor adjustments to the approved road layout and all associated site works. The proposed housing development is located 1.8km upstream of the proposed River Suir Sustainable Transport Bridge. The proposed residential developments are in discrete geographical locations. Therefore, no likely significant cumulative impacts are expected due to the proposed residential development.

Michael Hanrahan [Planning Ref: 17222]

An extension in duration of the planning application 12/500066 was granted in May 2017. The development comprises building 36 houses consisting 3 & 4 bedroom detached and semi-detached two storey and/or dormer style three storey houses. The three storeys of the dormer style house is created by a full or partial lower ground floor, estate entrances are provided from Gracedieu Road and Quarry Road and together with all associated site development works and all associated services installation. An AA Screening was carried out under planning application 12/500066 and no further AA was required, resulting in a conclusion that no adverse impacts on a Natura 2000 site would occur as a result of the development. The site is located 1.7km upstream of the proposed River Suir Sustainable Transport Bridge, adjacent to the Bilberry Industrial Estate.

These proposed residential developments are in discrete geographical areas and will be, or have been, subject to environmental requirements by the planning authority. The planning authority sets out requirements which must be followed by the developer to ensure best practicable means are implemented to prevent and minimise impacts due to surface water run-off during construction and operation of the development. Therefore, no likely significant cumulative impacts are expected due to the proposed residential developments.

Dermot Fitzpatrick – Prospect Lodge & Grounds, Gracedieu Road, Waterford [Planning Ref.: 9500222]

A mixed use development was granted permission in October 2010 on a site of 3.4ha. at Prospect Lodge (protected structure) and attendant grounds, Gracedieu Road, Waterford. The development consists of 97 no. dwelling units and construction of a two storey creche (216 sq.m.), change of use of part of Prospect Lodge from existing residential to office use (242sq.m.) and part residential 4 bed dwelling incorporating adjoining garden to west, including demolitions, renovations and alterations to existing building and walled garden. Together with associated site works, outfall sewers to Bilberry Road and River Suir, open spaces, landscaping, boundary treatments, car parking, and new vehicular access from Gracedieu Road west of Prospect Lodge. The development is located 1km upstream from the proposed development. Due to the distance from the proposed River Suir Sustainable Transport Bridge and the lack of a pathway, no likely significant cumulative impacts are predicted.

Respond! Housing Association

Permission was granted in May 2014 for the demolition of existing building and construction of 10 no. 2-bedroom sheltered housing units in 1 and 2 storey buildings and all associated site development works. The site is located approx 550m east of the proposed footbridge, on Abbey Road. The development is subject to environmental requirements by the planning authority which must be followed by the developer to ensure best practicable means are implemented to prevent and minimise impacts due to construction and operation of the development. Therefore, no likely significant cumulative impacts are expected due to the proposed housing development. An AA Screening completed by Waterford City Council found there to be no significant adverse impacts anticipated on the Lower River Suir SAC as a result of the proposed development. No likely significant cumulative impacts are expected.

S.E. Construction (Kent) Limited [Planning Ref.: 16675]

Permission was granted in 2017 for the construction of Phase 3: 44 No. dwelling houses at Cluain Lárach, Knockenduff, Tramore including alternations to existing services. T his project is 12km south west of the proposed development. The proposal includes modifications to the layout, and to the services associated to such modifications, for Phase 3 which is part of that as was granted planning permission under planning ref. no. 10/439 and being extended under Ref.No.16/390 for 98 houses. This phase 3 is for 44 houses_no.113 to 119 and 124 to 149, with 120 to 123 omitted due to their location relative to the residential zoned parcel of these lands as is included in the current Development Plan. The portion of the public green area and the portion of the estate road and path fronting houses 120 to 123 is included as part of this planning application. The layout includes 3 & 4 bedroom, two storey, semi detached & detached houses & all as a follow-on from Phase 1(20 houses under construction) and Phase 2 (14 houses the subject of planning application being processed under ref. 16/538). No likely significant cumulative impacts are expected due to the distance of the proposed development from the residential development and due to the scale of the construction works involved.

Noel Frisby, Carrickphierish, Gracedieu [Planning Ref.: 16/534]

Permission was granted in 2017 for the construction of 18 no. two storey houses and 2 No. two storey apartment blocks located 3km from the proposed River Suir Sustainable Transport Bridge. Block 1 will contain 6 No. 2 bedroom apartments. Block 2 will contain 5 No. 2 bedroom and 2 No. 1 bedroom apartments. Permission was also granted in 2017 for all associated site works. No likely significant cumulative impacts are expected due to the distance of the proposed development from the residential development.

17.6 Residual Impacts

Based on the above, it can be objectively concluded that, in view of best scientific knowledge, the River Suir Sustainable Transport Bridge will not result in any likely significant residual effects on the environment either alone or in combination, provided the prescribed mitigation is in place.

17.7 Conclusions

Major Accidents and Natural Disasters

There are no "Seveso" sites (establishments within the meaning of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015) in close proximity to the proposed development. The closest establishment is at least 1km east of the proposed development.

The design of the proposed development has taken account of the potential for flooding and it is considered that there is minimal flood risk as a result of the proposed development. In relation to accidents resulting in a spillage of polluting material, the risk of these occurring will be significantly reduced and if a spillage should occur the proposed development incorporates drainage to allow the spilled material to be contained and treated prior to discharge.

Interrelationships

The interrelationships between the individual environmental disciplines have been considered and assessed. It is concluded that once relevant mitigation measures are implemented, no residual likely significant effects will exist as a result of the construction or operation of the River Suir Sustainable Transport Bridge.

Cumulative Impacts

It is considered that the scale of the works and implementation of effective environmental control measures will avoid all likely significant effects on environmental parameters. There is no potential for cumulative impacts arising in combination with any other plans or projects and therefore no potential for in combination effects on environmental parameters.

Based on the above, it can be objectively concluded, in view of best scientific knowledge, on the basis of objective information and provided effective mitigation is in place, that the Project, individually or in combination with other plans and projects, will not have a significant adverse effect on the receiving environment.

Chapter 18
Mitigation Measures

ROD
ROUGHAN & O'DONOVAN

Comhairle Cathrach
& Contae Phort Láirge
Waterford City
& County Council

Chapter 18 Mitigation Measures

18.1 Introduction

Mitigation measures are the measures proposed in order to avoid, reduce or, where possible, remedy the significant adverse environmental effects of the proposed River Suir Sustainable Transport Bridge. Mitigation measures have been incorporated into the design of the proposed bridge and will be applied during both the construction and operation phase where they have been assessed as necessary.

This chapter provides a summary of the mitigation measures for the River Suir Sustainable Transport Bridge as contained within chapters 5 – 17 of the Environmental Impact Assessment Report (EIAR). This is a summarised version stating only the mitigation measures to be provided and does not discuss the requirement for the measure to be applied or the residual impacts. This chapter also deals only with mitigation measures to be applied to the River Suir Sustainable Transport Bridge and does not address the avoidance or reduction mitigation which has been applied through the design development.

18.2 General Mitigation and Monitoring Measures

Table 18.1 General Mitigation and Monitoring Measures

No.	Description
1.1	Construction Environmental Management Plan Prior to any demolition, excavation or construction a Construction Environmental Management Plan (CEMP) will be produced by the successful contractor. The CEMP will set out the Contractor's overall management and administration of the construction project. The CEMP will be prepared by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the outline CEMP, Environmental Operating Plan (EOP) and the Construction and Demolition Waste Management Plan (CDWMP). The Contractor will be required to include details under the following headings: • Details of working hours and days; • Details of emergency plan – in the event of fire, chemical spillage, cement spillage, collapse of structure or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services • Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages); • Details of construction plant storage, temporary offices; • Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing network traffic; temporary road closures; temporary signal strategy; routing of construction strategy; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements; • Truck wheel wash details (including measures to reduce and treat runoff); • Dust management to prevent nuisance (demolition & construction); • Landscape management; • Management of demolition of all structures and assessment of risks for same; • Stockpiles; • Project procedures & method statements for;

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td></td><td>

Demolition & removal of buildings, services, pipelines (including risk assessment and disposal);
Diversion of services;
Excavation and blasting (through peat, soils & bedrock);
Piling;
Construction of pipelines;
Temporary hoarding & lighting;
Borrow Pits & location of crushing plant;
Storage and Treatment of peat and soft soils;
Disposal of surplus geological material (peat, soils, rock etc);
Earthworks material improvement;
Protection of watercourses from contamination and silting during construction;

Site Compounds
The production of the CEMP will also detail areas of concern with regard to Health and Safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.
</td></tr>
<tr><td>1.2</td><td>
Environmental Operating Plan
The EOP is a document that outlines procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that can arise during the construction phase of a national road scheme. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractor during the project construction stage and will be limited to setting out the detailed procedures by which the mitigation measures proposed as part of the EIAR and NIS and arising out of the Boards decision (if approving the proposed development) will be achieved. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment.
Before any works commence on site, the Contractor will be required to prepare an EOP in accordance with TII/NRA Guidelines for the Creation and Maintenance of an Environmental Operating Plan. The EOP will set out the Contractor's approach to managing environmental issues associated with the construction of the scheme and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include:

All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the National Parks and Wildlife Services (NPWS) and Inland Fisheries Ireland (IFI) as well as a method documenting compliance with the measures;
A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and
Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment.

To oversee the implementation of the EOP, the Contractor will be required to appoint a suitably competent Site Environmental Manager (SEM) to ensure that the mitigation measures included in the EIAR, the EOP and the statutory approvals are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.
</td></tr>
<tr><td>1.3</td><td>
Construction and Demolition Waste Management Plan (CDWMP)
The CWDMP will be included within the CEMP, clearly setting out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline CDWMP has been prepared for the proposed development. The outline CDWMP is a live document that will be amended and updated to reflect current conditions on
</td></tr>
</table>

No.	Description
	site as the project progress. The obligation to develop, maintain and operate a CDWMP will form part of the contract documents for the project. The plan itself will contain, but not be limited to, the following measures: • Details of waste storage to be provided for different waste; • Details of where and how materials are to be disposed of – landfill or other appropriately licensed waste management facility; • Details of storage areas for waste materials and containers; • Details of how unsuitable excess materials will be disposed of where necessary; and • Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner.

18.3 Mitigation and Monitoring Measures for Traffic and Transport

Table 18.2 Mitigation and Monitoring Measures for Traffic and Transport

No.	Description
2.1	No mitigation measures for traffic and transport are deemed necessary. No significant impacts are predicted as standard best practice measures are incorpora1ted into the project design.

18.4 Mitigation and Monitoring Measures for Population and Human Health

Table 18.3 Mitigation and Monitoring Measures for Population and Human Health

No.	Description
3.1	Develop and implement all mitigation measures detailed in Chapter 4 (Description of the Proposed Development) this is to include development of Construction Environmental Management Plan (CEMP) and associated Traffic Management Plan (TMP) to address all modes of transport including the navigational channel and will be required to be agreed with WCCC prior to construction stage. • The TMP will be required to maximise the safety of the workforce and the public and minimise traffic delays, disruption and maintain access to properties. • The TMP will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points. • The contractor shall provide an appropriate information campaign for the duration of the construction works. • The TMP should minimise disruption to economic, marine users and residential amenities to be agreed by WCCC prior to construction and ensure access is maintained along the R680 for vehicles, pedestrians, cyclists and economic operators at all times and ensure marine navigation is maintained. • Include appropriate measures relating to working at heights and near water as part of EOP. Install and maintain ringbuoys as part of construction design stage in consultation with the Irish Water Safety and Waterford Search and Rescue Organisations.

No.	Description
3.2	The contractor will be required to develop and implement Stakeholder Management and Communication Plan and will be required to be agreed with WCCC prior to construction stage. • All stakeholders will be required to be agreed with WCCC prior to construction commencing. • Details of the general construction process/phasing will be communicated to the relevant stakeholders prior to implementation to ensure local residents and businesses are fully informed on the nature and duration of construction works.
3.3	Detailed design to identify a suitable location to relocate the pay station/ office in consultation with QPark operator to be agreed by Waterford City and County Council.
3.4	Noise and Vibration mitigation will be provided for during construction of the development. Measures to mitigate noise and vibration impacts on sensitive receptors are detailed within Chapter 12 Noise and Vibration. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities including the application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures.
3.5	In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan (refer to Appendix 13.1 of this EIAR).
3.6	Installation of 24/7 CCTV cameras across the bridge to be agreed by Waterford City and County Council prior to construction.
3.7	Design and maintain suitable landscaping and public realm infrastructure to complement other environmental mitigation, e.g. lighting, seating, landscaping, pleasant surroundings to discourage anti-social behaviour, graffiti, etc.
3.8	Implement the recommended mitigation measures detailed in Chapter 10 (Hydrology) to address potential risk of flooding.
3.9	Appropriate directional information signage will be put in place on local roads to guide residents and visitors to the use of the sustainable transport bridge, greenway and connections to other sustainable transport infrastructure.
3.10	Replacement of public amenities in suitable locations, as required (i.e. toilets, seating, bicycle stand and tourist information signage) on south quays as part of detailed design stage within the South Plaza or along the south quays and will be required to be agreed with WCCC prior to construction stage.
3.11	Install and maintain ringbuoys as part of detailed design stage in consultation with the Irish Water Safety and search and rescue organisations in Waterford.

18.5 Mitigation and Monitoring Measures for Biodiversity

Table 18.4 Mitigation and Monitoring Measures for Biodiversity

No.	Description
4.1	*<u>Sedimentation and surface water run-off</u>* In order to attenuate flows and minimise sediment input into the River Suir from site run-off, all surface water run-off from the construction site shall be directed to a temporary attenuation facility, where the flow rate will be attenuated and sediment allowed to settle out, before passing through a hydrocarbon interceptor and being discharged to the existing South Quays sewer network. Sheet piling for the new quay wall either side of the southern bridge abutment shall be installed prior to excavation on the south quays and demolition of the existing reinforced earth wall. This will form an effective barrier to run-off from the south quays during construction.

No.	Description
	The removal of cofferdams and temporary support piles will be undertaken at or near high water to maximise the dilution factor for any disturbed sediments and minimise the time during which any contaminants bound to disturbed sediment is suspended in the water column. Owing to the nature and scale of the Project, there will be minimal stockpiling of materials on site. However, any material stockpiled shall be located as far from the riverbank as practicable, covered and remain stockpiled for as short a time as possible. The Contractor shall provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour and the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk of input of sediment or construction materials into the river during flood events. Prior to the Construction Environmental Management Plan being accepted and implemented, it shall be submitted to both the NPWS and IFI to ensure that all requirements of those bodies are satisfied.
4.2	<u>*Cementitious materials*</u> The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of any input of cementitious material into the River Suir from the landside elements of the construction. In addition, all shuttering shall be securely installed and inspected for leaks prior to cement being poured and all pouring operations shall be supervised monitored for spills and leaks at all times. In order to eliminate any remaining risk of input of cementitious material into the River Suir from the landside elements of the construction, all pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather. In order to prevent input of cementitious materials into the River Suir from the in-stream elements of the construction, concrete structural elements shall be pre-cast, wherever possible. In addition, at all locations where concrete or other wet materials are to be used, bunded steel decks will be used to capture any spilled concrete, alkaline water displaced from inside tubular steel piles or spilled sealants or other materials. Any such materials collected on these platforms shall be transferred to the landside construction areas and disposed of in accordance with the Construction and Demolition Waste Management Plan.
4.3	Vehicles and plant shall be refuelled off-site where possible and all fuelling of machinery shall be undertaken at least 10 m from the River Suir. All fuelling of vessels shall be undertaken on an impervious base in bunded areas and all fuelling equipment shall be regularly inspected and serviced. Standing plant and machinery shall be placed on drip-trays. All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. shall be stored in the construction site compound, on an impervious base which shall be bunded to 110% capacity and appropriately secured. All plant and construction vehicles shall be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery. Spill kits shall be available on site during construction, including on the jack-up barge during pile driving.
4.4	Paints containing organotin compounds, e.g. TBT, shall not be permitted for use. In order to minimise the risk of paint spillage into the River Suir, a platform shall be provided to form an effective barrier between the repainting works and the River Suir, capturing any spilled paint or other chemical.
4.5	Construction lighting will be limited to the minimum area required to be lit and minimise light spill onto the river channel.

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>4.6</td><td>The following are the mitigation measures which will apply to pile driving:
• All pile driving shall be restricted to the following periods:
  o 1st June to 31st August, inclusive; and,
  o 1st November to 31st January, inclusive.
• All pile driving shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays.
• All pile driving shall be restricted to between 8:00 am and 6:00 pm.
• All breaks between pile drives shall be of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, all such breaks shall be concurrent.
• A 30-minute soft-start/ramp-up procedure shall apply to each pile drive.
• If, for any reason, a derogation from any of the above is required, this shall only be permitted with the consent of WCCC, the NPWS and IFI.
• All of the above shall be supervised by an Ecological Clerk of Works appointed by the Contractor.</td></tr>
<tr><td>4.7</td><td>The welfare of Otter will be ensured primarily through the provision of continued safe access for Otter upstream and downstream of the development. Adequate provision for Otter at the bridge crossing is required to allow the species to retain continued access throughout the River Suir. The design of the bridge includes a gap between the south abutment and the quay wall. This will allow the continued connectivity both for intertidal mudflats and for Otter at the south bank of the River Suir. This is not required on the northern bank where passage is maintained.</td></tr>
<tr><td>4.8</td><td>There will be no spillage of light to the river or to land within 10 m of the river banks. Therefore, no further mitigation is required in respect of lighting impacts on Otter.</td></tr>
<tr><td>4.9</td><td>The lighting design will ensure that no lighting is focused onto areas of ecological sensitivity including onto the River Suir and that lighting design provides for low levels of lateral light spillage to avoid unwanted areas of illumination.</td></tr>
<tr><td>4.10</td><td>The Contractor shall prepare a Biosecurity Protocol detailing his/her proposed approach to ensuring that invasive species are not imported or spread during construction. The Contractor's Biosecurity Protocol shall have the approval of the Ecological Clerk of Works prior to its acceptance and implementation.
The Biosecurity Protocol should include the following measures to prevent the spread of invasive species:
• Good construction site hygiene will be employed to prevent the introduction and spread of problematic invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving any site.
• All plant and equipment employed on the construction site (e.g. barges, piling equipment etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species
• All washing must be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the Construction Environmental Management Plan.
• Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present.
• All planting and landscaping associated with the proposed development shall avoid the use on invasive shrubs such as Rhododendron and Cherry Laurel.</td></tr>
<tr><td>4.11</td><td>Any available resources should be used to prevent the spread Common Cordgrass to new sites</td></tr>
<tr><td>4.12</td><td>Fish rescue
During the erection of cofferdams, there is a risk that fish may become trapped within. In order to prevent the death of these fish, they should be removed from the</td></tr>
</table>

No.	Description
	cofferdam during dewatering. Owing to the high conductivity, there is a significant Health & Safety issue with electrofishing within the cofferdams at this location. Therefore, rescue of any fish present within the cofferdams should be carried out using nets as the cofferdam is being dewatered.
4.13	**Water quality monitoring** Monitoring of water quality shall be undertaken in the River Suir, with samples taken monthly for at least 6 months prior to commencement, weekly for the entire duration of construction and monthly for at least 24 months post-completion. The parameters which shall be monitored, include but are not limited to: • Suspended solids and turbidity; • Total hydrocarbons; • Ammonia, nitrates, nitrites and total nitrogen; • Phosphates and total phosphorus; • Dissolved oxygen and biological oxygen demand; and, • Temperature and salinity. Samples shall be taken from at least two different locations, including at least one location at an appropriate distance upstream of the Project and at least one other at an appropriate distance downstream of the Project. The final number and location of sampling points will be determined by the Site Environmental Manager. Given the strong tidal influence at the location of the Project, the date and exact time at which each sample is taken, as well as the direction of flow, must be recorded in order to ensure that comparative analysis of samples can control for tidal influence, as well as other variables, e.g. fluvial conditions. The results of the water quality monitoring programme will be reviewed by the Site Environmental Manager and Ecological Clerk of Works on an ongoing basis during construction. In the event of any non-compliance with regulatory limits for any of the water quality parameters monitored, an investigation shall be undertaken to identify the source of this non-compliance and corrective action will be taken where the this is deemed to be associated with the Project.
4.14	**Hydroacoustic monitoring** In order to allow for greater accuracy in the assessment of future plans and projects, it is recommended that hydroacoustic monitoring be undertaken for the full duration of the proposed development's construction. This monitoring should establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) and more accurately characterise the sound outputs in terms of SPL and SEL at different frequencies arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be carried out by specialist underwater noise surveyors and the results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works, who may make appropriate adjustments / improvements to the mitigation in this EIAR based on the result so this monitoring.
4.15	**Record of intertidal habitats** In order to record any changes in the intertidal habitats, particularly mud habitats, in the vicinity of the proposed development, a photographic record shall be made of these habitats. This record shall cover both sides of the river from 150 m upstream of the proposed bridge location to 300 m downstream. All photographs shall be taken at low tide, every two months, beginning 6 months prior to commencement of construction and finishing 12 months after completion.
4.16	During construction, all works must comply with relevant legislation and guidelines in order to reduce and minimise environmental impacts and to protect all ecological receptors. In particular, there must be full compliance with the following: • The Schedule of Commitments. • The mitigation prescribed in this Chapter of the EIAR and in the NIS. • Any conditions which might be attached to the proposed development's planning consent.

No.	Description

	• Any requirements of stakeholders and statutory bodies, e.g. the NPWS and IFI, including:
	  ○ *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
	• All applicable legislative requirements in relation to environmental protection.
	• All relevant construction industry guidelines, including:
	  ○ *C532 Control of water pollution from construction sites: guidance for consultants and contractors* (CIRIA, 2001).
	• Any biosecurity requirements arising from the preceding points.
	• The Transport Infrastructure Ireland (TII) and National Roads Authority (NRA) Environmental Assessment and Construction Guidelines, specifically:
	  ○ *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes.*
	  ○ *Guidelines for the Treatment of Bats during the Construction of National Road Schemes.*
	  ○ *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.*
	  ○ *Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes.*
	  ○ *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes.*
	  ○ *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes.*
	  ○ *Guidelines on the Management of Noxious Weeds on National Roads.*
	  ○ *Guidelines for the Treatment of Noise and Vibration in National Road Schemes.*
	  ○ *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes.*
	  ○ *Management of Waste from National Road Construction Projects.*
	  ○ *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.*
	This list is non-exhaustive. All environmental commitments/requirements and relevant legislation and guidelines which are current at the time of construction will be followed.

4.17	The CEMP, the EOP, including the IRP, and the CDWMP are grouped together as Environmental Management Plans (EMPs). Outline Environmental Management Plans (EMPs) will be provided to the Contractor and it will be his/her responsibility to develop his/her own EMPs based on the outlines provided. Prior to their acceptance and implementation, the Contractor's EMPs will be subject to approval by the Site Environmental Manager and Ecological Clerk of Works as well as the Employer's Representative.
4.18	To ensure the successful development, implementation and maintenance of the EOP, the Contractor will appoint an independent Site Environmental Manager (SEM). The principal functions of the SEM will be to ensure that the mitigation prescribed in this EIAR, the NIS, the CEMP, the EOP and the CDWMP, is fully and properly implemented and to monitor the construction stage from an environmental perspective. The SEM will also provide independently verifiable audit reports.
4.19	Separate from the on-going and detailed monitoring carried out by the Contractor as part of the EOP, the SEM will carry out the inspection and monitoring described below on behalf of WCCC. The results will be stored in the SEM's monitoring file and will be available for inspection or audit by WCCC, the NPWS or IFI. • Daily reporting on weather and flood forecasting and daily reporting on the monitoring of water levels in the Lower River Suir.

No.	Description
	• Weekly inspections of the principal control measures described in the CEMP and reporting of findings to the Contractor. • Daily inspections of surface water treatment measures. • Daily inspections of all outfalls to watercourses. • Daily visual inspections of watercourse to which there are discharges from the works and those in the vicinity of construction works. • Weekly inspections of wheel-wash facilities. • Daily monitoring of any stockpiles. • Auditing at least six times per quarter of the Contractor's EOP monitoring results.
4.20	In order to ensure the successful development and implementation of the CEMP, the Contractor will appoint an independent Ecological Clerk of Works (ECoW).

18.6 Mitigation and Monitoring Measures for Soils and Geology

Table 18.5 Mitigation and Monitoring Measures for Soils and Geology

No.	Description
5.1	All suitable material excavated for installation of pile caps shall be re-used to the greatest possible degree as fill material on the development.
5.2	All unacceptable material excavated shall be disposed of in accordance with legislative requirements with due regard for the impact on the licensed waste disposal site. Where possible this material will be utilised in landscaping of the development.
5.3	A geotextile screen and boom with oil barrier will be required around marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as setting and driving steel casings and boring in overburden or rock from polluting the river. An Emergency Incident Response Plan (EIRP) shall also be required to deal with any unexpected spills during construction (See Appendix 4.1).
5.4	Minimisation of excavation and removal of potentially contaminated soils where alternative engineering solutions can be used in the proposed development to ensure the existing ground is capable of providing adequate formation to the south plaza.
5.5	Temporarily surcharging the footprint of the south plaza with an additional height of general fill in order to speed up the settlements in the underlying soft soils and alleviate the settlements in the operational phase. The surcharge will need to be held for 12 to 14 months. This hold period can also be significantly improved (down to 3 – 6 months) by installing vertical wick drains under the surcharge. Installing of wick drains is fast and produces minimal noise and vibration over general construction traffic levels. After the surcharge hold period, the temporary surcharge can be reused in other areas such as in the proposed park areas.
5.6	Surcharge height will be tapered back on the approach to the Clock Tower in order not to include the settlements to the protected structure. In addition, the Clock Tower will be equipped with the suitable monitoring equipment and instrumentation to closely monitor ground and vibration levels in real-time.
5.7	In case a piling option is selected to prevent the settlements under the south plaza, CFA piles at suitable depth and spacing will be specified in order to avoid the excessive noise and vibrations in close proximity to the surrounding sensitive receptors.

18.7 Mitigation and Monitoring Measures for Hydrogeology

Table 18.6 Mitigation and Monitoring Measures for Hydrogeology

No.	Description
6.1	Earthworks shall be carried out such that surfaces promote runoff and prevent ponding and flooding.
6.2	Runoff will be controlled and treated to minimise impacts to surface and groundwater.
6.3	Temporary pumping of groundwater shall be treated by means of a temporary sedimentation pond (or similar) prior to discharge.
6.4	All hazardous materials will be sorted within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase.
6.5	Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction.
6.6	Mitigation measures during the construction phase will include implementing best practice during excavation works to avoid sediment entering the River Suir (refer to Chapter 10 of this EIAR for details).

18.8 Mitigation and Monitoring Measures for Hydrology

Table 18.7 Mitigation and Monitoring Measures for Hydrology

No.	Description
7.1	An Environmental Operating Plan (EOP) has been prepared and the following will be implemented: • A draft Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance incident with any permit of licence or other such risks that could lead to a pollution incident. • All necessary permits and licenses for in stream construction work for provision of the bridge and landings will be obtained prior to commencement of construction. • Inform and consult with IFI and WI. • Implement the Environmental Operating Plan contained in Appendix 4.1 of Volume 3 of this EIAR. This draft EOP will be developed by the selected construction contractor to suit the detailed construction methodology and allocate responsibilities to individuals in the construction team. In doing so, the measures detailed in the appended reports will be considered minimum requirements to be considered and improved upon.
7.2	Site works will be limited to the minimum required to undertake the necessary elements of the project.
7.3	As far as is practicable, construction works shall proceed within predetermined Construction Areas on a phased basis.
7.4	Surface water flowing onto the construction area will be minimised through the provision of berms, diversion channels or cut-off ditches.
7.5	Management of excess material stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be undertaken. This may involve allowing the establishment of vegetation on the exposed soil and the diversion of runoff water from these stockpiles to the construction settlement ponds.

No.	Description
7.6	Protection of waterbodies from silt load will be carried out through use of timber fencing with silt fences or earthen berms to provide adequate treatment of runoff to watercourses.
7.7	Settlement ponds, silt traps and bunds will be used. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap.
7.8	The anticipated site compound/storage facility on the South Quays will be fenced off at a minimum distance of 10m from the top of the edge of the quay/river edge. Any works within the 10m buffer zone will require measures to be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the watercourse. See the OCEMP within the EOP in Appendix 14.1.
7.9	Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with the NRA/TII document "Guidelines for the crossing of watercourses during the construction of National Road Schemes". All chemical and fuel filling locations will be contained within bunded areas and set back a minimum of 20m from watercourses.
7.10	Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution.
7.11	The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses.
7.12	Riparian vegetation (if present) along the River Suir will be fenced off at a distance of 3m either side of the proposed crossing point to provide a buffer zone for its protection.
7.13	Hydrophilic grout and quick-setting mixes or rapid hardener additives shall be used to promote the early set of concrete surfaces exposed to water.
7.14	When working in or near the surface water and the application of in-situ materials cannot be avoided, the use of alternative materials such as biodegradable shutter oils shall be used.
7.15	Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters.
7.16	Placing of concrete in or near watercourses will be carried out only under the supervision of the Ecological Clerk of Works (ECoW).
7.17	There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials. Such spills shall be contained immediately, and runoff prevented from entering the watercourse.
7.18	Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses and lakes.
7.19	On-site concrete batching and mixing activities will only be allowed at the identified construction compound areas.
7.20	Washout from concrete lorries, with the exception of the chute, will not be permitted on site and will only take place at the construction compound (or other appropriate facility designated by the manufacturer).
7.21	Chute washout will be carried out at designated locations only. These locations will be signposted. The Concrete Plant and all Delivery Drivers will be informed of their location with the order information and on arrival to site.
7.22	Chute washout locations will be provided with an appropriate designated, contained impermeable area and treatment facilities including adequately sized settlement tanks. The clear water from the settlement tanks shall be pH corrected prior to

No.	Description
	discharge (which shall be by means of one of the construction stage settlement facilities) or alternatively disposed of as waste in accordance with the Contractor's Waste Management Plan.
7.23	Monitoring of water quality shall be undertaken in the River Suir, with samples taken monthly for at least 6 months prior to commencement, weekly for the entire duration of construction and monthly for at least 24 months post-completion. The parameters which shall be monitored, include but are not limited to: • Suspended solids and turbidity; • Total hydrocarbons; • Ammonia, nitrates, nitrites and total nitrogen; • Phosphates and total phosphorus; • Dissolved oxygen and biological oxygen demand; and, • Temperature and salinity. Samples shall be taken from at least two different locations, including at least one location at an appropriate distance upstream of the Project and at least one other at an appropriate distance downstream of the Project. The final number and location of sampling points will be determined by the Site Environmental Manager. Given the strong tidal influence at the location of the Project, the date and exact time at which each sample is taken, as well as the direction of flow, must be recorded in order to ensure that comparative analysis of samples can control for tidal influence, as well as other variables, e.g. fluvial conditions. The results of the water quality monitoring programme will be reviewed by the Site Environmental Manager and Ecological Clerk of Works on an ongoing basis during construction. In the event of any non-compliance with regulatory limits for any of the water quality parameters monitored, an investigation shall be undertaken to identify the source of this non-compliance and corrective action will be taken where the this is deemed to be associated with the Project.

18.9 Mitigation and Monitoring Measures for Landscape and Visual

Table 18.8 Mitigation and Monitoring Measures for Landscape and Visual

No.	Description
8.1	An opaque hoarding will be erected of a minimum 2.0 metres in height around the site compound and works area on the South Quays.
8.2	Hours of construction activity will be restricted in accordance with local authority guidance.
8.3	Visually, the arched profile and colour of the bridge and good quality materials used (steel, glass and concrete) compliment the environment.
8.4	Bridge landing areas are designed to create high quality public spaces with paving, green space and walling. Some ornamental planting is also integrated into the design for the Meagher's Quay landing and within the South Quay Plaza which will aid in addressing the sensitive context of the Clock Tower.
8.5	Lighting will not be focused onto the River Suir and the lighting design will provide for low levels of lateral light spillage to avoid unwanted areas of illumination.
8.6	Monitoring and maintenance of the bridge and landscape will be required to ensure that there is no deterioration in the quality of the proposed elements over time which could lead to greater levels of visual impacts.

18.10 Mitigation and Monitoring Measures for Noise and Vibration

Table 18.9 Mitigation and Monitoring Measures for Noise and Vibration

No.	Description
9.1	No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
9.2	Best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
9.3	All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
9.4	Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
9.5	Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
9.6	During construction, the contractor will manage the works to comply with noise limits outlined in *BS 5228-1:2009+A1 2014. Part 1 – Noise.*
9.7	All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.
9.8	Hours will be limited during which site activities which are likely to create high levels of noise or vibration are permitted.
9.9	Levels of noise and vibration will be monitored during critical periods and at sensitive locations.
9.10	Channels of communication will be established between the contractor/developer, Waterford City and County Council and residents so that receptors are aware of the likely duration of activities likely to generate higher noise or vibration
9.11	A Site Environmental Manager (SEM) will be appointed by the Contractor to be responsible for matters relating to noise and vibration
9.12	Plant with low inherent potential for generation of noise and/or vibration will be selected.
9.13	Good quality, printed site hoarding will be erected around the South Quays which will act as a noise barrier to general construction activity at ground level.
9.14	Barriers will be erected as necessary around items such as generators or high duty compressors.
9.15	Noisy plant will be situated as far away from properties as permitted by site constraints.
9.16	Normal working times will be 07:00 to 19:00 hrs Monday to Friday and 08:00 to 16:30 hrs Saturday and Sunday. Works will not be undertaken outside these working hours without the written permission of Waterford City and County Council.
9.17	Piling works will only be permitted between 08:00 to 18:00hrs Monday to Friday during the months of June, July, August, November, December and January.
9.18	The Clock Tower will be equipped with the suitable monitoring equipment and instrumentation to closely monitor vibration levels in real-time during construction works in order to ensure compliance with the thresholds defined in Section 12.3.1 and Table 12.6 of the EIAR. Should the specified vibration levels be exceeded works swill cease until an appropriate solution has been identified.
9.19	During operation, best practice guidelines will be adhered to by plant servicing the bridge.

No.	Description
9.20	Noise monitoring will be undertaken during the initial 6 month period following the opening of the bridge and should baseline noise levels at Receptors R3 and R4 be exceeded by more than 3dB, additional noise mitigation measures will be adopted.
9.21	Hydroacoustic monitoring will be undertaken for the full duration of the construction of the proposed development. This monitoring will establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) and more accurately characterise the sound outputs in terms of SPL and SEL at different frequencies arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be undertaken on a continuous basis for the duration of construction and the results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works.

18.11 Mitigation and Monitoring Measures for Air Quality and Climate

Table 18.10 Mitigation and Monitoring Measures for Air Quality and Climate

No.	Description
10.1	Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
10.2	Any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
10.3	Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities such as rock blasting or earthworks are necessary during dry or windy periods.
10.4	Before entering onto public roads, trucks will be adequately inspected to ensure there is no potential for dust emissions and will be cleaned as necessary.
10.5	The contractor will be required to erect opaque hoarding of a minimum 2.0m in height around the site compound and works area on the South Quays. The hoarding shall be a high gloss printed finish with information and graphics about the project or as agreed with Waterford City and County Council. The precise hoarding type shall be agreed with Waterford City and County Council prior to works commencing.
10.6	In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

18.12 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

Table 18.11 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

No.	Description
11.1	It is recommended that removal of any quayside masonry or furniture should be carried out under archaeological monitoring to facilitate further recording. It may be deemed appropriate to retain and reuse any elements of particular cultural heritage significance as part of the development and these can be identified during archaeological monitoring.
11.2	The riverbed surrounding Piers D and E will be enclosed within cofferdams as part of the construction process. The cofferdams are to be dewatered as part of that process; it is recommended that an additional archaeological inspection of the riverbed within the footprint of the cofferdam is undertaken.

No.	Description
11.3	Photogrammetry of the stone quay at the North Quay landing point of the proposed development should be undertaken in advance of the commencement of construction works. The photogrammetry survey should be annotated and a record should be made of the section of quay wall being removed.
11.4	All excavation works should be archaeologically monitored by experienced, licensed underwater archaeologists with a proven track record in equivalent, similar type work. Should archaeological material, wreckage, timbers or other artefacts be recorded in the course of the monitoring, the archaeologist will be empowered to recover and record the material. This may involve the temporary suspension of the work to recover the material. In the event that excavation works impact on an archaeological site, the standby archaeological dive team, in place for such eventualities, should be mobilised to undertake a dive inspection of the impacted site which may lead to further investigations and / or potentially full excavation.

18.13 Mitigation and Monitoring Measures for Architectural Heritage

Table 18.12 Mitigation and Monitoring Measures for Architectural Heritage

No.	Description
12.1	Mitigation will be required on the quay where the landing of the new bridge will be located, necessitating the formation of a breach in the stonework of the quay. This should be mitigated by making good either side of the breach in the wall with stones salvaged in the works and laid in a lime-based mortar to match the stonework of the original wall.
12.2	Any cut stone removed from the quay wall or the surface of the quay is to be reused in a similar manner or, where this is not possible or appropriate, the stone is to be salvaged and stored for future use elsewhere along the quays.
12.3	Mitigation will be required to safeguard the Clock Tower during the works. The Clock Tower is to be excluded from the working area and the hoarding surrounding the working area is to be located outside the ring of post-and-chain fencing around the northern, eastern and western sides of the tower.
12.4	Prior to the commencement of works and prior to the erection of the site hoarding a detailed photographic record of the Clock Tower is to be made showing both the interior and the exterior of the tower. A report based on this photographic survey is to be prepared and lodged with the Conservation Officer, with a copy also lodged with the Waterford City and County Libraries Central Library.
12.4	Prior to the commencement of the works on the quays a vibration monitor is to be set up within the Clock Tower and this is to have the facility to send an alarm to a designated engineer in the event of the vibrations within the tower exceeding a predetermined limit to be set by the engineer at a level below which any damage to the tower through vibration is likely to occur.

18.14 Mitigation and Monitoring Measures for Material Assets and Land

Table 18.13 Mitigation and Monitoring Measures for Material Assets and Land

No.	Description
13.1	Measures to control the production of dust will be put in place by the contractor (refer to Chapter 13 Air Quality and Climate which presents a series of measures to control dust).

No.	Description
13.2	Noise mitigation will be provided during construction of the development. Measures to mitigate noise impacts on sensitive receptors are detailed within Chapter 12 Noise and Vibration. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities
13.3	A Traffic Management Plan will be implemented during construction in order to minimise disruption to local residents, commercial business operators and the general public.
13.4	Access will be maintained for vehicles, pedestrians and cyclists at all times during the construction phase.
13.5	The new drainage system along the South Quay will be designed to ensure that the current drainage situation will not be impacted and there will be no increased risk of flooding as a consequence of the River Suir Sustainable Transport Bridge.
13.6	Any services that are interfered with, including services to the marina, as a result of the proposed development will be repaired or replaced without unreasonable delay.
13.7	It is anticipated that a combination of a sufficiently open and lit area will be enough to prevent groups from congregating. More secure gates will be installed at the marina gangways to ensure a higher level of protection for boat owners as a result of increased numbers of passers-by.
13.8	Communication will be maintained with the Port of Waterford and the Harbour Master during construction works.
13.9	Compensatory car parking spaces are available across Waterford City. New car parks have recently opened in the city. Directional signage will be erected to assist visitors. The development of the SDZ area will result in increased parking facilities in the area.
13.10	The removal of berths will be compensated at the marina downstream of the proposed bridge.
13.11	All construction works will be temporary and will be carried out in line with best practice guidelines thus minimising the impacts to the receiving communities.
13.12	The contractor will work within stringent construction limits and guidelines to protect surrounding amenities.
13.13	As discussed in Chapter 4 of this EIAR, a Construction Environmental Management Plan (CEMP) will be implemented by the contractor and will ensure commitments included in the statutory approvals are adhered to.

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